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Sketch of the Life and Work of William A. Lighthall.

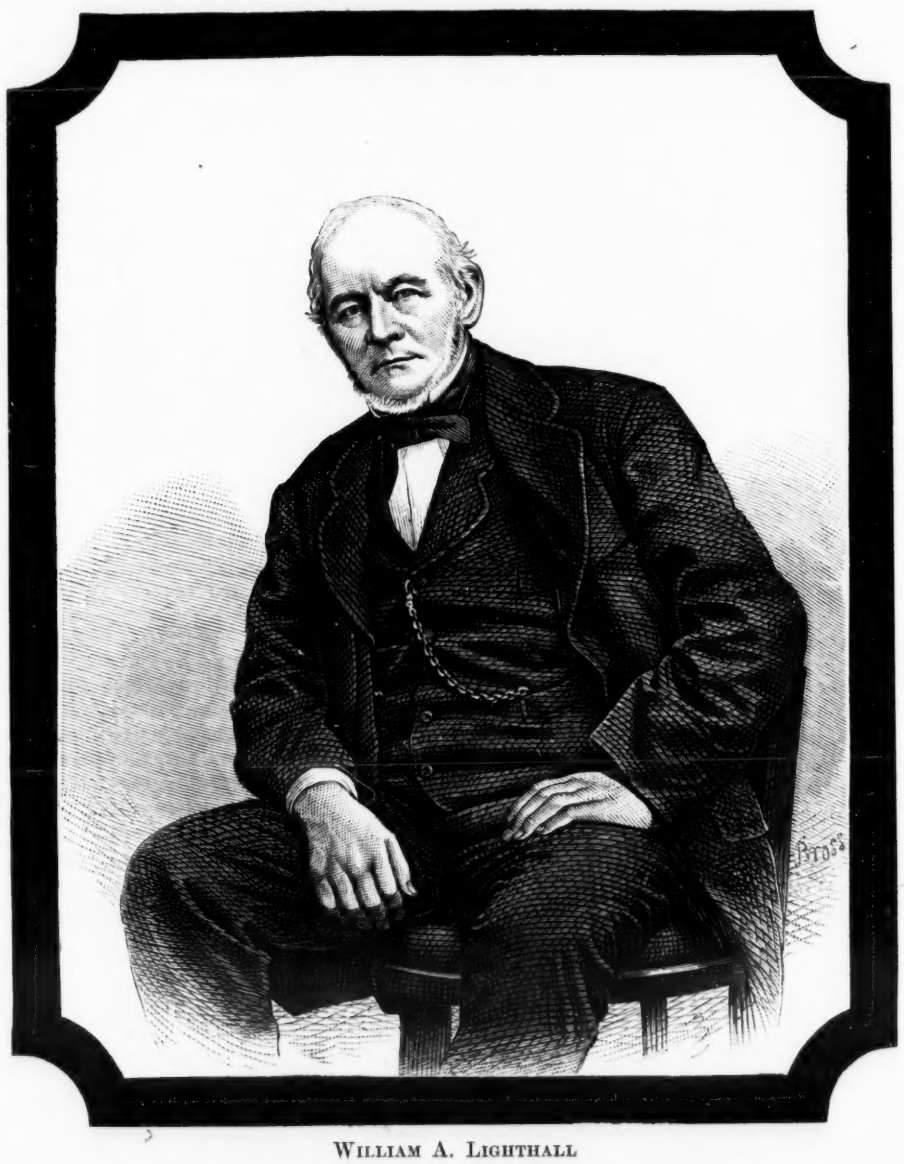
The subject of this sketch, William Abram Lighthall, whose portrait appears herewith, was born in Albany, New York, September 16, 1805, and died of pneumonia at his residence, in Brooklyn, N. Y., Jan. 4, 1881. His parents were from Holland, and from that hardy stock young William inherited a robust constitution.

As soon as the boy was old enough to do the lightest work, he assisted his mother in working the loom, by the aid of which she wove the cloth necessary to clothe the family. At a very early age the remarkable will and determination which so distinguished him in after years, became noticeable. He would frequently leave home when displeased with some domestic affair, leaving his parents in ignorance of his whereabouts, until they would hear of his being with some relative at work on his farm. When tired of farming, he would return home. Young William attended school only in the winter, and but a few seasons, being engaged with other duties during the summer. At that time Albany had about 15,000 inhabitants.

Finally, his father, who was a blacksmith and wheelwright by trade, and had the reputation of being the best edge tool maker in that section of the country, took the boy to assist him in the shop.

His duties were to blow the bellows, and to do other light work. Not being satisfied with the trade of his father, he very soon began to show a disposition to experiment with simple mechanical movements, which were set in motion by water wheels placed in the brooks and rivulets about the homestead.

When about eighteen years of age, having become competent to make a good wagon and cart wheel, he went to work under the instructions of a neighbor named Harris, who was a millwright and general mechanic of high standing in his profession. Millwrighting in those days had a broad meaning, implying that a mechanic bearing the title of millwright was not only capable of making wheels, but of working skillfully at the mechanical trades, generally.



WILLIAM A. LIGHTHALL

Very soon afterwards Mr. Harris, assisted by his enterprising apprentice, built a large mill for grinding plaster. The power was furnished by a large windmill and all the machinery ran so easily and so fast that the friction upon one of the journals caused the mill to take fire and burn down.

They next built a distillery, on a new principle, at Greenbush. A new stationary steam engine was used to drive the machinery. This was the first steam engine ever brought into that neighborhood, and it caused the people to turn out and view it as a great curiosity. The operation of the engine pleased young William, and added greatly to his reputation as well as that of his employer.

This was the first experience that the young man ever had with the steam engine, and he was so delighted with it that he resolved to adopt engineering as a profession. After serving his time faithfully with Mr. Harris he left Albany, and as there were no railroads at the time, started for New York on a sailing vessel. Probably no individual ever set foot in New York more destitute of city acquaintances and influence than did William A. Lighthall. He went to James P. Allaire, of the Allaire Works, then located on Cherry street, near the East river, and applied for work. That gentleman, liking his appearance, gave him several pieces of work to perform, which were executed so satisfactorily that he was given steady employment under instructions. Under the direction of Mr. Allaire he was rapidly pushed forward, being sent out upon small boats and placed in responsible positions.

It is related that he was employed in 1825, in removing the engines of Fulton's steamer, the Clermont, the first steam craft that ran between New York and Albany. The first steamer of large dimensions upon which he appeared as engineer was the DeWitt Clinton.

This boat had a beam engine and consumed about 40 cords of wood in running from New York to Albany. While upon this boat he described to some associates the plans of the surface condenser, and began to work up some ideas connected therewith. He shortly afterwards left that boat and accepted a position as engineer upon the Champlain, a steamer belonging to the Troy Steamboat Company. The engines of the steamers Champlain, Troy and Empire, were built under the supervision of Mr. Lighthall. These were the first large steamers constructed for navigating the Hudson river

The steamer Troy was the second built, and Mr. Lighthall took the engines belonging to the Erie, a companion boat of the Champlain, and used them in the Troy. They were formerly of the vertical beam type, one engine attached to each side of the boat, making each wheel independent. The cylinders were 46″ or 50″ diameter and 10 feet stroke. These engines could not be kept in line on account of the unstable manner in which they were secured to the boat. When they were removed to the Troy the cylinders were placed in a horizontal position, the ends of the beams being vertical. These changes while being executed, were severely criticised by engineers, but proved very successful when put into practice.

In this position the engines necessarily occupied more horizontal space, but worked much better and were more easily kept in line, also greatly increased the speed of the boat. After completing the Troy, Mr. Lighthall became superintendent and constructing engineer of the steamboat line.

The successful operation of these engines led to the invention of the Lighthall Patent Half-Beam engines, which soon became extensively known. It is believed that the first marine counter was invented and used by Mr. Lighthall upon the Champlain, to mark the number of revolutions made by her engines. This device was made from the works of an old clock, and a similar arrangement was used for years afterwards upon all engines under his supervision. The eccentricities of Mr. Lighthall became very marked during these experiments. Frequently he would cause the eccentrics of the engine to be shifted a dozen times during a trip, in order to determine their proper position. While chief engineer of the Champlain, in 1831 or 1832, he experimented extensively with a rotary, and besides developing a very good engine for hoisting purposes he succeeded in producing an excellent rotary pump.

He designed and superintended the construction of several engines for boats, exclusive of the work of the company by whom he was employed. Among them may be mentioned a ferry boat, about the year 1838, for Robert Schuyler, who then owned the Jersey City ferry. Another boat, called the Mutual Safety, had a half beam engine with a horizontal cylinder, in which, to economize space, a connection was made from the crosshead to the crank by means of a beam resembling half of the beam used upon marine beam engines, hence its name. The cylinder with this arrangement was located directly beneath the shaft. This engine was the first of the Lighthall half-beam engines. The steamer Mohegan was built in 1838 for running to Stonington, Conn., the railroad to Providence being just opened. It was upon this boat that Mr. Lighthall introduced the plan of solid pins, used to form the hinges and hold the valves upon the piston of the air pump. The plan described is now universally used, without improvement, upon the air pumps of beam engines. Previous to this improvement, the valves were held by copper pins and keys, which frequently came out, causing a general smashing of the machinery.

The steamer Empire was built in 1842 for the Troy Line, which was considered a model of excellence. The engines were the half-beam type, and the boat was very successful. Mr. Lighthall left the Troy Co. in 1843, and, in conjunction with some friends, built and owned the steamer Rip Van Winkle. The engines of this vessel were of the half-beam type, and furnished with a number of essential improvements. She was a fast boat. During the administration of President Polk, he was appointed superintendent and constructing engineer in the revenue service, and superintended the construction of the Robert J. Walker, at Richmond, Va., and

the Thos. Jefferson, at Pittsburgh, Pa. He was afterwards employed to bring the revenue steamers from the lakes after the treaty was passed withdrawing the vessels from those waters.

In 1849 a stock company was formed, which, under Mr. Lighthall's direction, built an iron vessel, called the Erastus Corning, in sections, to navigate the rivers and harbors of California. The sections were shipped upon the bark Sarah Sands. Mr. Lighthall and several others were landed at the Isthmus of Panama, which they crossed and took a steamer on the other side for San Francisco. This steamer got short of coal, and put into a bay about 250 miles from that city. The probability was that the vessel would have to lie there for several weeks. Six men, headed by Mr. Lighthall, became impatient, and started for San Francisco on foot, encountering every conceivable hardship.

When about fifty miles from their destination one of the party named Lovell accidentally shot himself through the head, killing him instantly. Mr. Lighthall determined to give the body a respectable burial with appropriate ceremonies, so he carried the remains on his back, notwithstanding he had a wounded leg, until the party reached San Francisco several days later.

This event showed the true character of the man. His was a choice combination of will and determination, blended with a kind, sympathetic and charitable disposition, such as is seldom seen.

The Erastus Corning had half beam engines. It was put together and run upon the San Joaquin river for three years. While in San Francisco Mr. Lighthall fitted out a small side wheel steamer, about 100 feet long, for use at the Sandwich Islands. He sailed in this vessel for that destination, making the trip in safety, although his friends in San Francisco bade him good bye, never expecting to see him again.

From 1849 to 1852 he was Government Inspector-General of Steam Vessels and Machinery for the State of California. After this he returned to New York, where he filled the position of Government Inspector of Steamboats and Boilers for the State. He subsequently built and ran the steamer Cornelia for river trade in California, in the service of Grinnell, Minturn & Co. In 1854 he again returned to New York, and accepted the position of Superintending Engineer of a new line of ocean steamers owned by Commodore Vanderbilt. About the year 1855 or 1856 he designed and built the engines of the steamer Vanderbilt, which was remarkable for speed as a Government vessel during the war. She was driven by two powerful beam engines placed side by side and connected to one shaft. The first surface condenser was invented and used upon this vessel in 1857 to furnish drinking water. This style of condenser was afterwards extensively used in forts and government vessels. He left the employ of Commodore Vanderbilt in 1857 to engage in the manufacture of surface condensers, and followed this business actively almost to the day of his death.

The first surface condenser applied directly to the marine engine was upon the steamer Salvor in 1859, and was successful. The first patent was taken out for these condensers June 11, 1861. They have since become extensively used upon all classes of steam vessels, all over the world. Mr. Lighthall was an extensive inventor, and took out about fifty United States patents.

Mr. Lighthall was not given to money making, although he acquired and spent several comfortable fortunes. In his experiments he never hesitated by reason of cost. Persons who were acquainted with Mr. Lighthall will readily recognize the portrait upon the first page, as he generally assumed the position shown when relating his experience, or giving an opinion upon engineering subjects. He was for a number of years a member of Dr. Scudder's church in Brooklyn, and in a quiet way performed many acts of charity during his career. His wife died about two years ago, and the family now living consists of five daughters and two sons.

Shop Kinks—No. IV.

RATCHET DRILLING DEVICE.

By L. F. LYNE.

It is a matter of much surprise to me, in visiting different shops, to see so few adaptations of inexpensive devices for saving time and labor. Probably in using the ratchet drill, the greatest amount of time is wasted and greater stupidity exhibited and tolerated, than by any other shop process. To set forth the advantages and disadvantages in connection with the use of the drill would necessitate the writing of quite a book, so I will, at present, confine myself to one simple operation in the use of the ratchet drill.

In the AMERICAN MACHINIST, of July 12, 1879, I described (with a cut) a very simple knee or support for the ratchet drill, which is reproduced as part of the accompanying illustration, Fig. 1. It consists of a piece of $\frac{3}{4}'' \times 2\frac{1}{2}''$ flat iron, *b*, bent to a right angle, the bottom part being 12″ and the upright 20″ to 24″ in length. To insure greater stiffness the bottom part should be $\frac{7}{8}''$ or 1″ thick. Both parts are perforated with a number of holes; those in the bottom to facilitate attaching the device to a stud or bolt, while those in the upright part are for the purpose of adjusting the small knee *c*, to suit the length of drill and ratchet *d*.

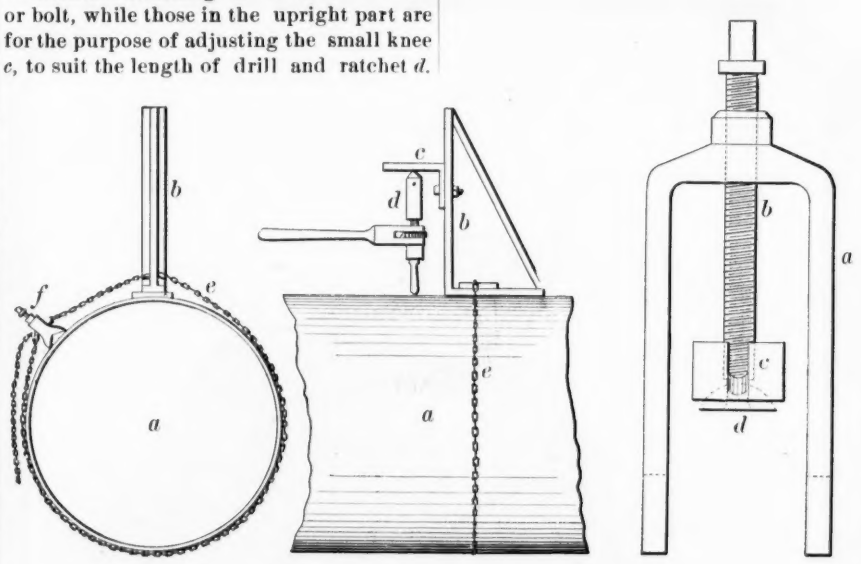


Fig. 1.

The peculiar feature of this device, and the one which renders it particularly valuable, is a $\frac{3}{4}''$ round iron brace welded to the extremes of the horizontal and vertical parts of the knee *b*. This prevents springing and throwing the drill from a straight line. By a practical test, it has been proved that a man, with one of these knees, can drill a hole in half an hour which took another man two hours with a knee, such as is generally used, but without a brace. The hole, too, was very crooked, caused by the springing of the knee. The amount of time and wages saved by the improved tool, in the single case referred to, was more than sufficient to pay the cost of the improvement. Why, then, are employers so backward in adopting such desirable tools, particularly when the cost is only the material and time in making them? Drilling, when possible, should be done under a drill press, yet there are cases where holes have to be drilled with a ratchet, and often in positions where there are no means of conveniently attaching the proper support for the drill. Under these circumstances, it often takes longer to "rig up" than it does to drill the hole. Such a case is illustrated by Fig. 1, which represents the shell of a boiler *a*, through which it is necessary to drill one or more holes. It is generally customary to cut such holes with a chisel, but I have frequently known the sheets to be split, and the grain of the iron separated by this common system of "butchery." All holes to be put through a boiler shell should be drilled.

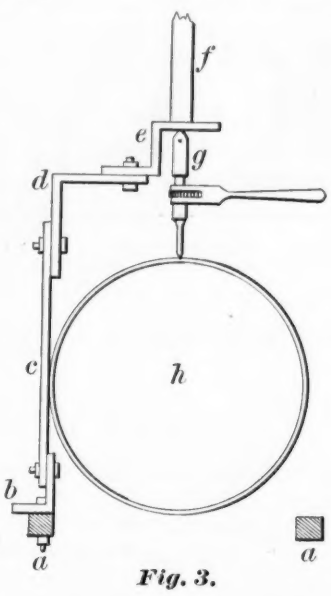


Fig. 3.

Some years ago I made the device, here shown, for holding a knee upon round surfaces of all common diameters. It is simple and easily made, consisting of a piece of common straight link chain *e*, which is wrapped around the boiler and tightened by being attached to a swivel hook *c*, at the end of a screw *b*, shown in Fig. 2. A ball joint *d*, allows the hook *c*, to tip in all directions.

The screw *b*, is attached to a simple saddle *a*, which is easily made, and can be modified to suit circumstances.

In use the screw *b*, is placed in its lowest position and the chain hooked up short; then, by turning the screw, the chain is subjected to a strain sufficient to securely hold the knee.

I will give a single illustration of how the work of drilling holes for sand-box studs is done in one of our leading locomotive shops, and will describe the rigging as I saw it.

Referring to Fig. 3, *h* represents the shell of the boiler, and *aa*, the engine frames. A knee *b*, was clamped to the frame, having a flat bar *c*, bolted to it. Another knee *d*, was bolted to the top of this bar and another knee *e*, to the end of that.

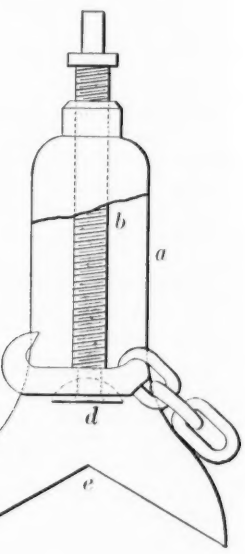


Fig. 2.

The ratchet *g*, was placed in position and a piece of timber *f*, cut to a proper length to reach the floor above. It took two men to erect this apparatus, and required the same number to operate it after it was completed. This is no exaggerated example, as there are hundreds of shops in the country where men will persist in creating such monstrosities to the detriment of the quality of work and financial loss to the proprietors.

IMPROVED OSCILLATING ENGINE.

Improved Oscillating Engine.

The accompanying illustration represents an improved oscillating engine designed for small boats, elevators, or in other situations where power is required and there is but little room in which to develop it.

The principal improvement is in the valve gear, by which a common slide valve is used, with or without link motion. The motion of the valve is not affected by the oscillating of the cylinder. The valve has lap and lead and can be set to cut off the same as common slide valve engines.

These engines are designed, with a long stroke in proportion with the bore, to reduce friction on moving parts; at the same time those parts are made as large as possible to make them durable.

The engraving is from a photograph of one with 4 inch bore, 16 inch stroke (link motion), which ran 200 revolutions per minute and reversed instantly backwards and forwards, while standing on blocks on the shop floor without bolting down. These engines are

built by the patentee, J. F. Kingsley, Owego, Tioga County, N. Y.

The Pulley Crank.

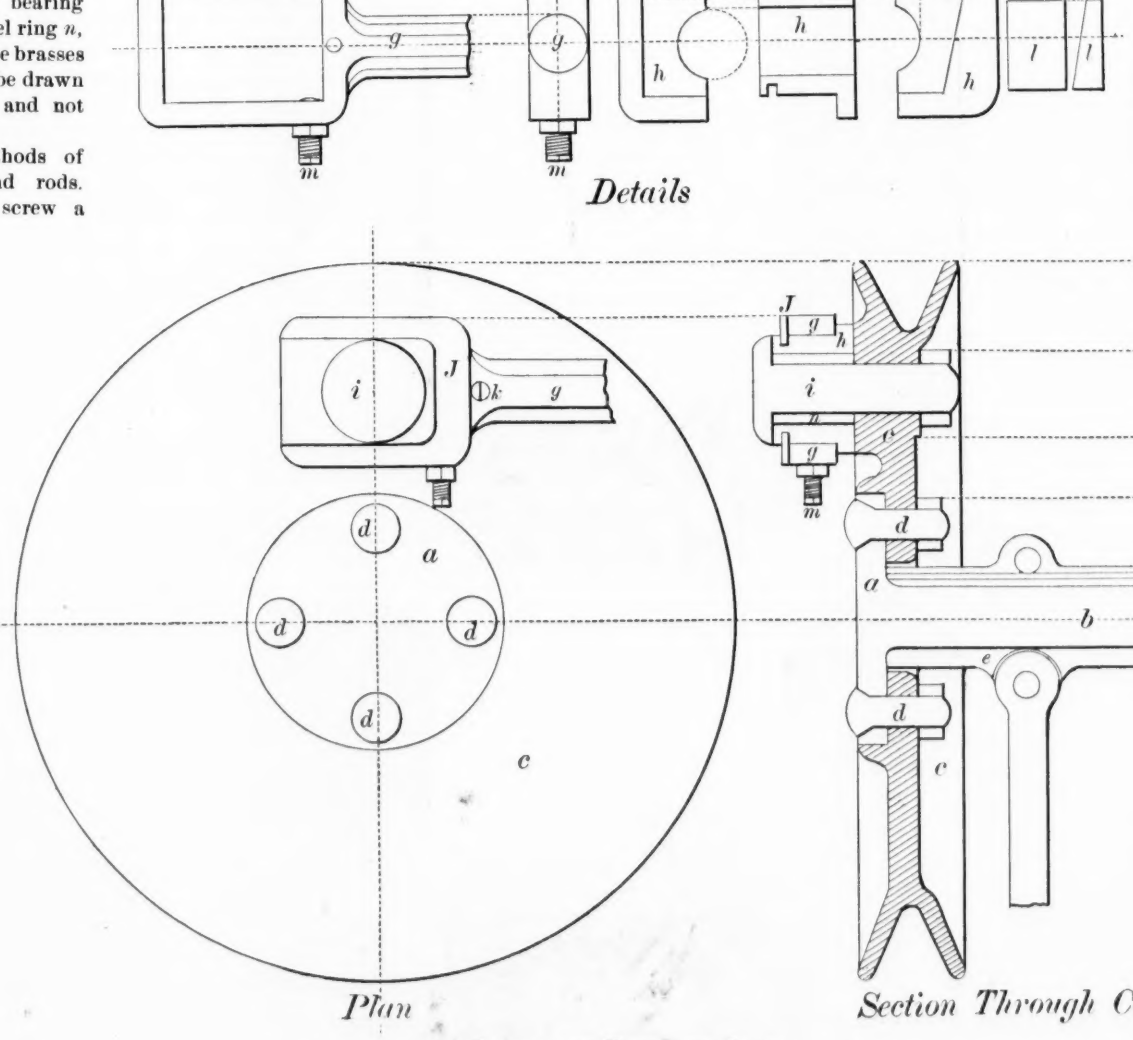
BY F. G. WOODWARD.

The style of crank here shown is now much in use among engine builders. Its advantages are, that it serves both as a balance and a pulley, can be screwed more firmly to the shaft, and has a more comely appearance.

An excellent method of constructing this style of crank is shown in the illustrations. A solid flange *a*, is forged on the end of the shaft *b*, nicely turned and faced up and fitted to a recess in a cast-iron pulley *c*. The flange and pulley are held together by four snugly-fitted bolts *d*, their heads being countersunk in the flange, as shown. This method of fitting permits the main box *e*, to be placed very closely to the plane of motion of the crank *f*.

The sketch also shows a very satisfactory plan of fitting up the ends of the connecting rod *g*. The parts are shown both in detail and assembled. The opening for the reception of the brasses *h*, is made wide enough to pass over the collar of the crank pin *i*. The brasses have a collar only on their inner ends, being held in place by a steel slide plate *j*, grooves being cut in the brasses for its reception, as shown. The slide is secured by a set screw *k*. The brasses are adjusted to the crank pin by the usual wedge *l*, and set screw *m*. The crank-pin bearing consists of a hardened steel ring *n*, made a trifle longer than the brasses in the rod, so that it may be drawn up snugly to the pulley and not bind the brasses.

There are several methods of fitting up these solid-end rods. Some makers prefer to screw a false collar upon the crank-pin, but it is not so safe as the plan here shown.



A SIMPLE AND EFFECTIVE CRANK.

One of the most gratifying indications of the new year is the upward tendency of mechanics' wages. Good skillful workmen are becoming scarcer and scarcer, and do not have to look around much for situations. Common workmen, however, are sought for but little more than they were last year.

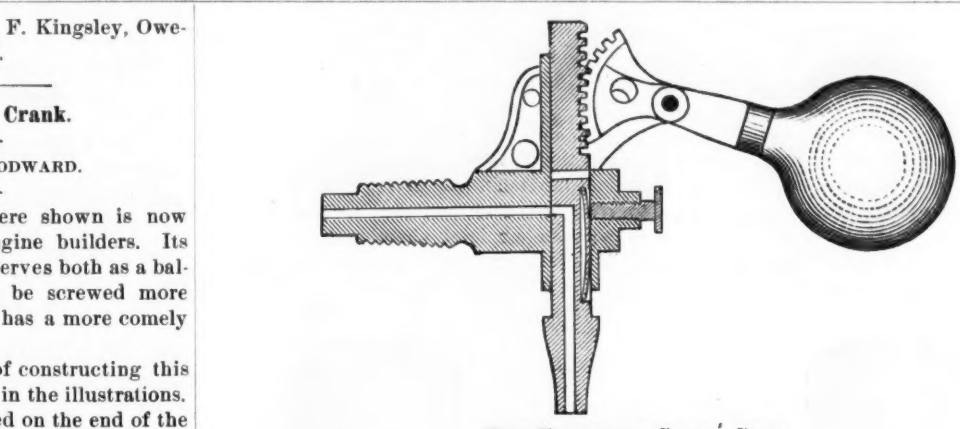
The Iowa City Board of Trade has published a 23-page pamphlet giving a sketch of Johnson Co., Ia., its early history, its educational, manufacturing, agricultural, and other interests. Every manufacturing establishment and educational institution is noticed *seriatim*. We commend this enterprise as worthy of imitation by boards of trade and similar commercial associations in other sections of the country.

The Fairbairn Gauge Cock.

Some of the essential and peculiar features of the Fairbairn Gauge Cock, illustrated herewith, are the following: It requires no packing, is self-closing, and can be cleaned out while steam is in the boiler without burning the hands or face. Its construction is very clearly shown in the sectional engraving.

Lifting the ball throws the pipe down and connects directly with the water in the boiler, allowing it to discharge at the bottom. When sediment in the water collects sufficiently to stop up an ordinary gauge cock, thereby cutting off the means of ascertaining the height of water in the boiler and becoming a source of danger, all that is necessary to do is to give the little thumbscrew three or four turns, releasing the spring, which allows the handle to be raised high enough to bring the upper hole in the piston down opposite the connection to the boiler, and even with the thumbscrew, which has a hole through it, thus making a direct connection to the boiler. A wire can then be pushed clear through into the boiler, and after the passage is cleared the handle can be dropped down, the thumbscrew can be turned up, cutting off all escape of steam, and all is perfect again.

This gauge cock is not an experiment; but has been thoroughly tried for several years, and has proved efficient and reliable. It is manufactured by the New England Gauge Co., 13 Doane St., Boston, Mass. New York office, 165 Broadway.



THE FAIRBAIRN GAUGE COCK.

Gen. Ulysses S. Grant has been elected President of the World's Fair Commission.

Inspection of Engines.

According to *Engineering*, at a recent meeting of the Manchester Steam Users' Association, a return was given of the consumption of coal per indicated horse power per hour of all the engines enrolled, the results being arranged not under the names of the members, but under their index numbers, which are known only by the individual members to whom they belong, and not by the general body. This table will enable one member to compare the economical results attained by his engine with those attained by others. Also this table gives the consumption of oil and tallow, as well as a description of the boilers and engines employed, in addition to the machinery driven, which it is thought will prove valuable for reference. An analysis of this table shows that the average consumption of coal per indicated horse power per hour was 3.66 lbs. in compound condensing engines, and 5.88 lbs. in single cylinder condensing engines, so that the average consumption of fuel in the compound condensing engines under inspection was 62 per cent. of that of the single cylinder condensing engines. The most economical results attained in four engines on the compound system, and in four engines on the single cylinder system, were as follows: On the compound system the results were: In the first case, boiler pressure, at time of indication, 73 lbs. on the inch; consumption, 2.1 lbs. per indicated horse power per hour. In the second case, boiler pressure, 81 lbs.; coal consumption, 2.35 lbs. In the third case, pressure, 61 lbs.; coal, 2.42 lbs. In the fourth case, pressure, 78 lbs.; coal, 2.6 lbs. On the single cylinder system the results were: In the first case, boiler pressure, at time of indication, 43 lbs. on the inch; coal consumption, 3.24 lbs. per indicated horse power per hour. In the second case, boiler pressure, 72.5 lbs.; coal consumption, 3.69 lbs. In the third case, pressure, 59 lbs.; coal, 3.85 lbs. In the fourth case, pressure, 35 lbs.; coal, 4.11 lbs. The results reduced to a mean, for more ready comparison, work out as follows: Compound condensing engines, boiler pressure, at time of indication, 78 lbs.; coal, per indicated horse power per hour, 2.37 lbs. Single cylinder condensing engines, boiler pressure, at time of indication, 52 lbs.; coal, per indicated horse power per hour, 3.72 lbs. Consumption of coal in the four compound condensing engines 63.7 per cent. of that in the four single cylinder condensing engines.

In the total number of compound condensing engines under inspection, the average initial pressure above the atmosphere was 55.82 lbs., and the average mean pressure on piston 19.8 lbs., while the average vacuum in cylinder at end of stroke was 11.2 lbs. In the single cylinder condensing engines the respective pressures were 26.23 lbs., 17.18 lbs., and 10.73 lbs.

The report recommended that taps should be fixed to the condensers to allow of an indicator being applied so as to check the accuracy of the vacuum gauges. In the twenty engines to which such taps have been fixed, the loss between the vacuum in cylinder at midstroke and the vacuum in the condenser was 1.09 lbs.

The average mean pressure on the piston of all the engines indicated was 18.89 lbs., so that a loss in the vacuum of 2 lbs. would reduce the average power of all the engines under indication by a little more than 10 per cent. Where the degree of expansion is considerable, the reduction in power that would result from a similar loss of vacuum would be greater still.

A narrow gauge railroad is to be built from Chattanooga, Tenn., to the top of Lookout Mountain, and a hotel to accommodate one thousand guests will be built on the mountain.

Regenerating Metallurgical Furnaces.

BY JACOB REESE.

A PAPER READ BEFORE THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

The regenerating principle as applied to heating furnaces was patented and made known by Robert Stirling in the year 1817. His invention relates to heating air, gases and fluids by the agency of air, gases or fluids passing through passages formed of brick, metal, stone or any other material, readapted to the degree of heat required, and he describes his invention as applicable to the manufacture of glass, pottery and any other case where great heat is required.

This principle has been embodied in improved apparatus, and practically utilized for metallurgical operations by Charles W. Siemen and Frederick Siemen, and is now in general use in the open hearth process. The advantages of the system are: 1. A more perfect and uniform combustion of the fuel; 2. the utilization of slack or other cheap material; 3. the recovery and return to the furnace of a large percentage of the caloric of the waste gases; 4. greater facility for securing and maintaining a high and uniform temperature; 5. readily securing an oxidizing or a carbonizing flame during treatment of the metal.

In the construction of these regenerative furnaces, the regenerators have been placed below ground, and generally beneath the furnace. This arrangement I believe to be objectionable on account of the following reasons: 1. the arrangement renders it inconvenient to secure a sufficient length of heating surface for the passage of the incoming and outgoing air and gases; 2. the ground is generally damp and wet, and considerable heat is lost by radiation and absorption; 3. the regenerators are very difficult to get at for cleaning and repairs; 4. the continual changing of the temperature causes their walls to crack, and their alternate expansion and contraction is liable to destroy the solidity of the furnace, or to crack the bottom and allow the molten metal to run down into the regenerators; 5. the metal is liable to boil over and run down as in the preceding case.

In order to overcome these objectionable features, I have designed a new arrangement and construction of the regenerators, in which the stoves are made of a cylindrical form, encased in wrought-iron shells, placed entirely above ground, and are connected with opposite ends of the furnace by combustion chambers, as is shown in the plates connected herewith, in which

Fig. 1 indicates a front elevation of the improved regenerative open-hearth furnace.

Fig. 2 indicates a sectional elevation of the same.

Fig. 3 indicates a cross sectional plan view of the same.

Fig. 4 indicates a cross sectional elevation of the upper portion of one of the stoves.

Fig. 5 indicates a top view of one of the stoves.

Fig. 6 indicates a front sectional elevation of the improved regenerative open hearth, provided with an oblique revolving bottom, such as is shown and described in English Letters Patent No. 1,223, granted in 1853 to Walker & Warren for improvements in the manufacture of iron.

Fig. 7 indicates a cross sectional view of the same.

Fig. 8 indicates a front elevation of an improved regenerative heating furnace.

Fig. 9 indicates a cross sectional view of same.

The construction and arrangement of the regenerators, as applied to the ordinary open hearth, may be readily understood by reference to Figs. 1 and 2, which indicate the arrangement, and Figs. 3, 4 and 5, which disclose details of construction. It will be observed that the stoves are of a cylindrical form; that they are provided with iron shells and are placed entirely above the ground, one being at each end of the furnace, and connected thereto by means of a combustion chamber at one side of its base. Each stove is divided into two distinct and separate compartments, by means of a division wall, which extends from its base up to the top of the dome, as is indicated in the sectional view of the top shown in Fig. 4. This division wall is placed somewhat to one side of the center of the stove, so that the compartment for the air may have a larger area than the compartment for the gas. Both of these compartments are subdivided into two sections, which communicate together at the dome, by means of vertical division walls, which extend from the bottom of the compartments upward to that point, and each of the subdivisions is filled with fire-brick in lattice arrangement, which extends up to the top of the subdivision walls, so that the air and gases may ascend in one subdivision and turn in the dome, and return downward in the other subdivision of their respective compartments. The bottom of these compartments, upon which the lattice work rests, is formed by the perforated arched roofs of the distributing and combustion chambers at the base of the stove. The distributing chambers are provided with a central double-valve chamber, to admit the outward passage of the waste gases into the stack, and to regulate the draught from the same; and they are also provided with an air inlet chamber open to the atmosphere, and with a gas inlet chamber communicating with the producers, for the admission of the air and the gas into their respective distributing chambers and compartments.

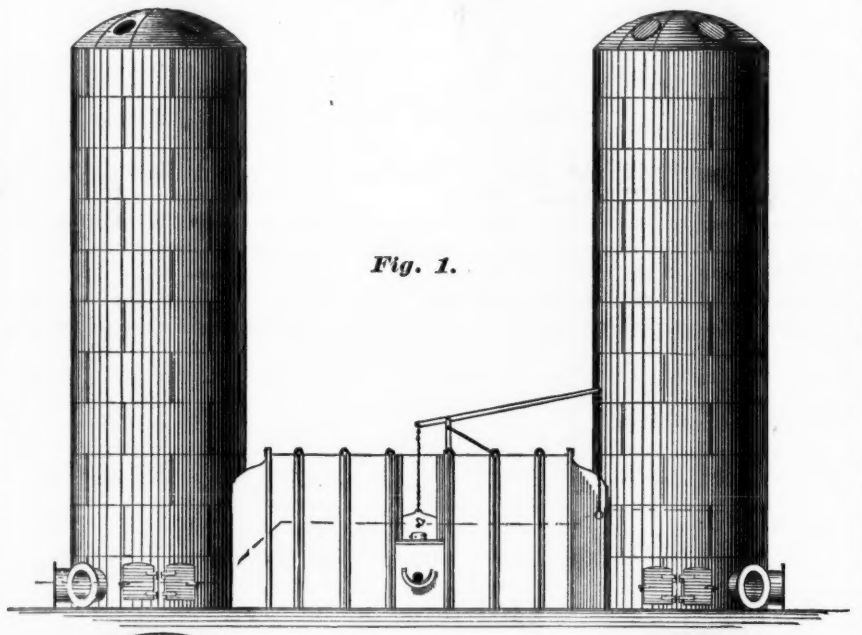


Fig. 1.

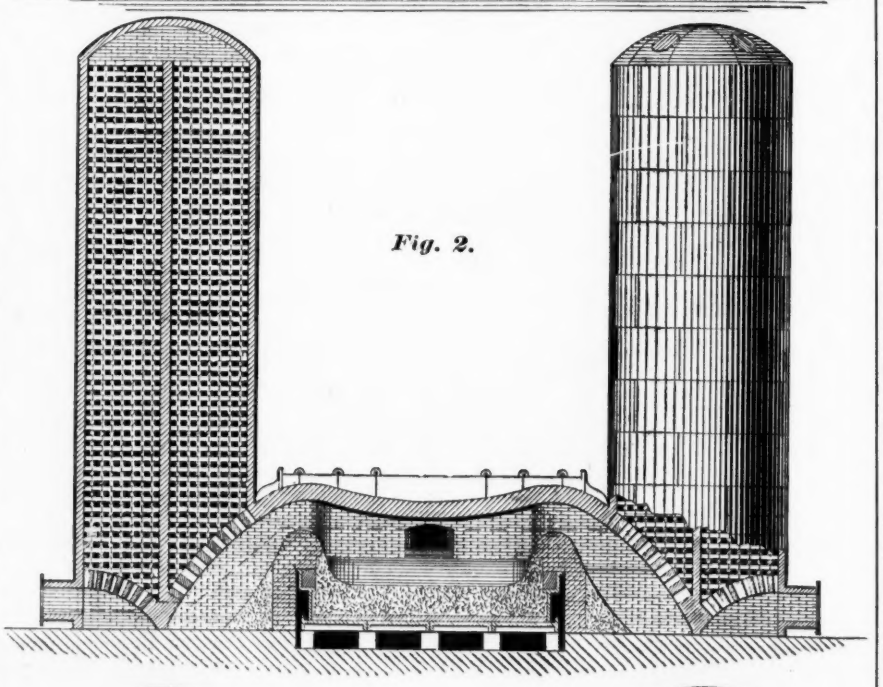


Fig. 2.

Fig. 5.

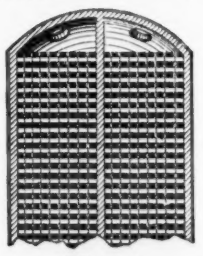


Fig. 4.

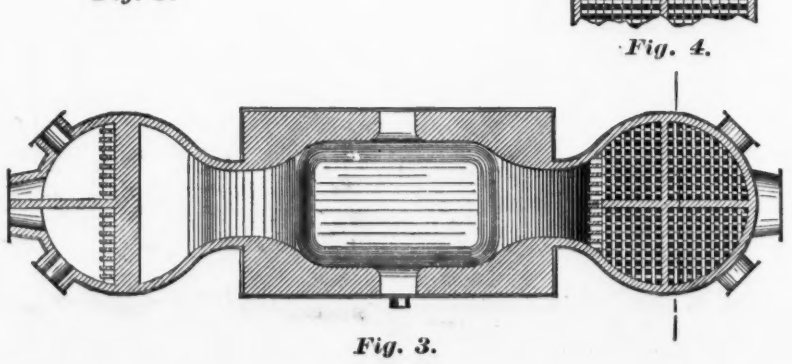


Fig. 3.

The stoves are provided with manholes in the top of the dome, in order to admit entrances for repairing, and to allow the insertion of mechanism for cleaning. The manholes are closed when the stoves are in use, by caps, as shown in Fig. 5. The stoves are also provided with cleaning doors, which open into the distributing chambers and the combustion chamber, in order to allow the removal of the dust, slag, and other matters which may collect therein during the cleaning of the regenerators or working of the furnace.

Figs. 6 and 7 indicate my improved arrangement and construction of regenerators, in connection with a Walker and Warren oblique revolving hearth. In this case, the only difference in construction is that of the furnace proper, which is fully set forth in their English Letters Patent, No. 1,223, of 1853.

Figs. 8 and 9 indicate my arrangement and construction of regenerators as applied to heating furnaces.

In the construction of a ten ton plant, such as is shown in Figs. 1 and 2, I propose to make the stoves about 10 feet in diameter by 35 in height, which will require 30,450 brick for the outer walls, 10,174 for the division walls and arches, and 20,580 for the lattice work. This construction will give a passage way of 70 feet for the air and gases through each regenerator, and 12,720 square feet of heating surface to each pair of stoves, being 7,500 square feet more than that of the ordinary form of regenerators applied to such furnaces, consequently, in practice, the temperature of the outgoing waste gases will be reduced to a much lower, and the temperature of the incoming air and gases will be raised to a much higher point than has been secured by the use of the ordinary plant, and an exceedingly high temperature may be easily and economically maintained in the furnace.

One of the reasons for constructing the stoves with so great a length of passage-way for the air and gases, and with so great an area of heating surface, is that they are designed to be used in cases where a very high and constantly uniform temperature is required. It is well known that iron and steel are more fluid at any given temperature when they possess the most carbon, and that the molten metal containing the least carbon, requires the greatest heat to keep it in the fluid condition. Now, in designing these stoves, I had in view the production of ingot iron very low in carbon, by desiliconizing and decarburizing the metal in a silicious-lined converter, and then running it into an open hearth, excluding the slag, for further treatment either by the acid or by the basic process. This decarburized metal requires a very high and continuous temperature to keep it in a fluid condition, and, as it is run into the open hearth without the slag, it must be protected from oxidation. Therefore, to secure these conditions as far as possible, the area of the heating surfaces and the lengths of their passages have been greatly increased, and a combustion chamber is formed at the base of each stove, so that combustion will take place previous to the entrance of the gases into the metal chamber.

The operation of the regenerators is as follows: Gas is admitted from the producers into the gas-distributing chamber, and air into the air-distributing chamber of one of the stoves, and its double outlet chamber is closed. The double outlet chamber of the opposite stove is opened to create a draft from the stack, and its air and gas inlet valve chambers are closed. The draft from the stack draws the air and gas through the perforated arched roofs of their respective chambers, up through the lattice work into the dome, where they turn and pass downward through the lattice work of the other division of their respective compartments into the combustion chamber, where they commingle, are consumed, and the products of combustion pass into the furnace, over the metal chamber, into the combustion chamber of the opposite stove, upward through the lattice work, into the dome, and then pass downward through the lattice work of the other subdivisions, into the distributing chambers, and from there, through their double outlet chamber, into the stack.

When the lattice work of the stove has been sufficiently heated, the currents are reversed by opening and closing the proper valves, and the cold air and gas, in passing upward and downward through its lattice

work, absorb the heat which has been deposited there by the outgoing waste products of combustion, and when they commingle in the combustion chamber, an intense and vivid combustion takes place, and an exceedingly high temperature is produced. After this operation has continued for about half an hour, the currents should be again reversed, and the stoves alternately subjected to the action of the outgoing waste gases and to the action of the incoming air and gases as described.

In the operation just described, the outgoing waste gases will enter the stove at a temperature of about 4,000 degrees, Fahrenheit, and, on account of their long passage and the great heating area of the stove, they escape into the stack at a temperature of about 400°, so that a saving is effected of $\frac{9}{10}$ths of the caloric, which, in ordinary non-regenerative furnaces, escapes into the air.

The cost of these regenerative stoves will be about $3,500 for a pair of the size specified, which is greater than that of the ordinary underground brick work, but as their heating surface and capacity is so much greater, and as I believe they possess a construction and arrangement which obviates the objectionable features which characterize the ordinary construction and arrangement, I hope to find their use very advantageous in the refining of ordinary open-hearth steels, as well as for the production of low ingot irons by the method to which I have referred.

This construction and arrangement will also be applicable to steam boilers and to all furnaces where it is desirable to use cheap fuel, to avoid smoke, and to maintain a high, constant, and uniform temperature.

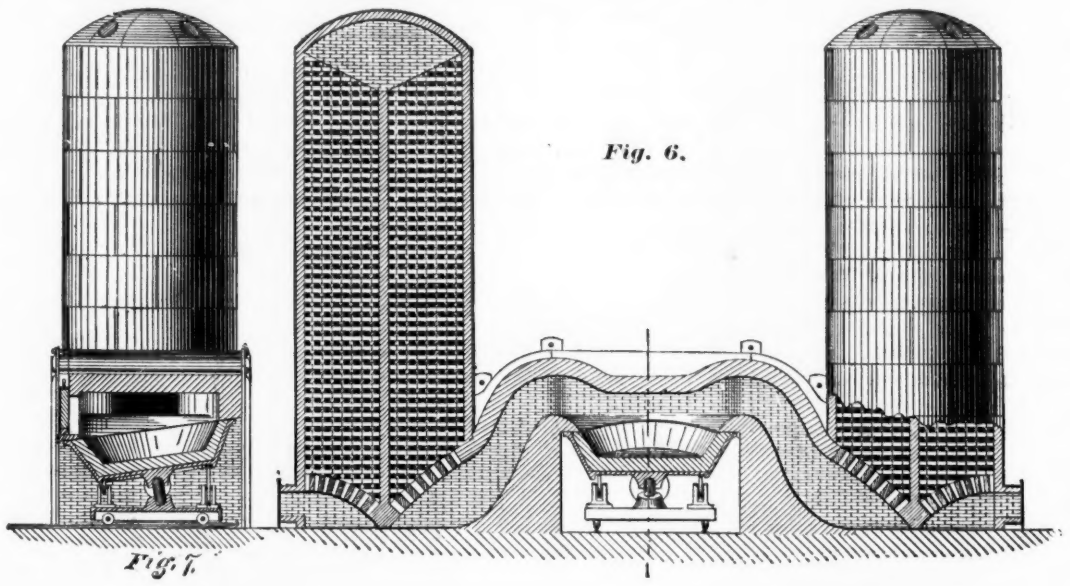


Fig. 6.

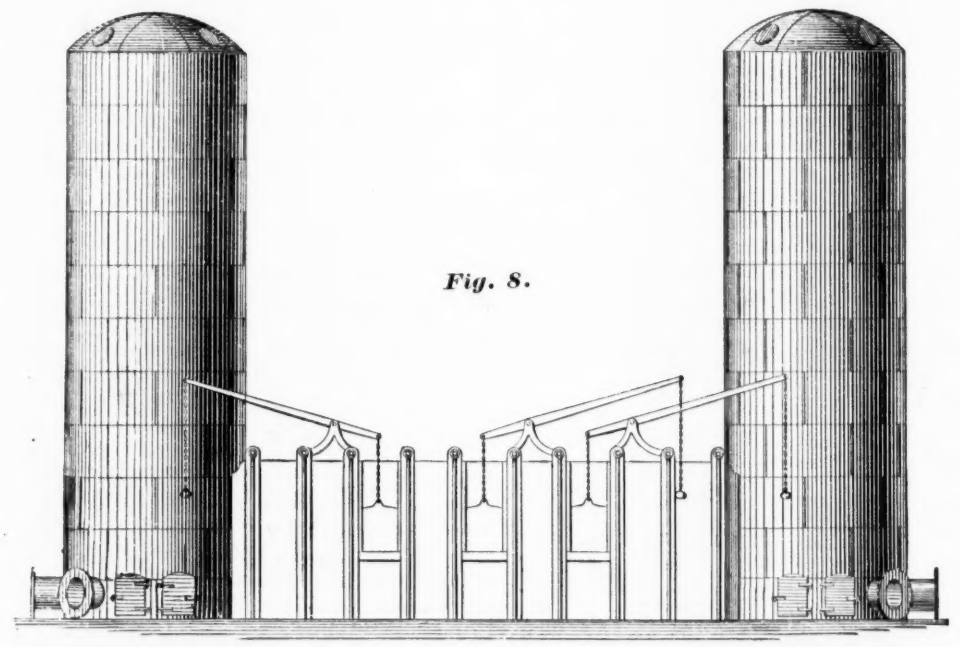


Fig. 8.

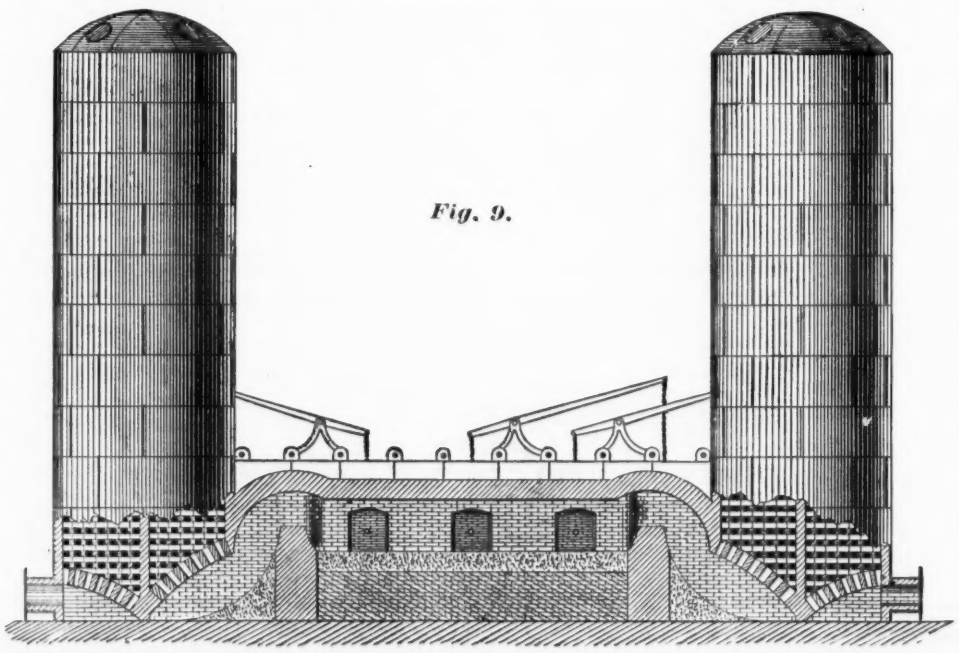


Fig. 9.

LETTERS FROM PRACTICAL MEN.

What Marine Engineers Should Do About Unsafe Boilers.

Editor American Machinist:

I was called a short time ago to take charge of a steamer which had only lately been built, having run only about four months. The boiler, a steel one, was tested to carry 100 pounds of steam, but almost from the start the chief engineer had trouble with the boiler, for which he could not account, and the owners thought the only way to overcome this difficulty and save expense would be to change engineers.

I looked at the boiler, as I am generally accustomed to do in taking charge of a new boat, and found to my surprise that, in place of having a boiler safe to carry 100 pounds of steam, it was unfit to carry 10 pounds. The side sheets were all buckled out between each of the sockets, which were only 4″ from center to center of threads in the crown sheet. This sheet was arched, but had come down about 3″ below its proper place, along the center forming a corrugation. All the tubes were burnt, and every bolt and socket in the boiler leaked. The owners thought the boiler perfectly safe to run, and insisted on my taking her out. But, I reported the same to the local inspectors, and, upon examination, the boiler was condemned. The braces for holding the crown sheet, where the most strain is, were in the shape of a turn buckle with the tubes running through the loops. Every one of these braces was pulled down, so that the sides pinched the tubes, causing considerable elongation. I think, if every engineer who has charge of a boiler would make it his business to report any unsafe condition of boilers, and the owners were compelled to have the matter attended to at once, there would be less cause for accidents. Boilers are inspected once every year, but a boiler with bad usage can be put into such a condition in that time that it would be unfit to boil water in, much less to carry a heavy steam pressure. The repairs in the case here cited cost about $2,000.

HENRY LOHMAN,
340 West 11th Street, New York.

Making Parts Interchangeable Without Standard Gauges.

Editor American Machinist:

I perfectly agree with Mr. Goodyear in his strictures upon the "pet gauge" system; and in this connection, a brief account of my experience during the war, will probably be of interest to your readers.

It fell to my lot to have charge of a very small shop in the South at that time. There was a great demand for the Southern "Spinning Jenny," which is a compound of cotton gin, carding machine, and spinning frame. It is a very small affair, and is usually driven by "one-man power," taking in cotton in the seed at one end, and turning out a more or less finished but strong thread at the other. It is quite complicated, usually has ten "spindles," and has a good many pieces in each machine that are, or should be, exactly alike. To make them at all in any quantity they must necessarily be made interchangeable.

The machinery at our command for manufacturing these machines consisted of one pretty good, old fashioned, screw-cutting engine lathe, and about a dozen other lathes, for which a manufacturer now-a-days would not give standing room in his back lot. I did not know much about standard gauges in those days, and I have often thought since that it was a good thing I didn't. I never once thought *then* that there could be any other way to make the parts interchangeable, than to make one piece of each part of the machine as perfect as possible, mark it "Standard," and make the parts of each machine as near like it as possible. Although we had all kinds of "raw hands" and "detailed men" in the shop, the work made in this manner was fairly accurate, and I do not think there is any other method that, with the men and machines we used, would have done as well.

PETER JOSSERAND.
Hockley, Texas.

The Foreman and the Foundryman.

Editor American Machinist:

I notice in your issue of December 25th, that "A Foundryman" is moved to reply to the "Notes of a Foreman upon Castings." I am glad to see this topic started, as to my mind there is none more worthy of thorough discussion at the present time. In the production of castings through the intelligent and hearty co-operation of all the parties who are concerned in the operations—the draughtsman, the pattern maker, the metal pattern maker and the moulder—we are, in the matter of economy and of satisfactory achievement, scarcely abreast of the times. The foreman, I must acknowledge, to be an intimate and life-long personal associate of my own, and I should be glad to call the foundryman one also. I, of course, leave the foreman to his own defence and my remarks may be taken as those of a neutral. I must say, however, that the foundryman can scarcely be one of long experience or he would not be so sensitive as to call the remarks of my friend, the foreman, unkind. That foreman prides himself upon the careful precision of his statements and the honeyed sweetness of his disposition. A foundryman in any locality within my experience would have become so toughened by the hyperborean blasts of exasperated machinists, that the remarks of our friend, the foreman, would feel to him as the balmiest of breezes.

I notice that the foundryman denies none of the foreman's charges, but merely tries to plead extenuating circumstances. Castings are bad, because the draughtsman and the pattern maker don't consult the moulder. If the moulder sees that a thing is impossible, what kind of a man is he to attempt it? Every skilled producer has a right to insist upon not merely the possible, but upon the very best conditions for the successful exercise of his craft. Indeed, what is skill but the knowledge to choose and the courage to insist upon the requisite conditions? He is not the best workman who, after a job is spoiled, is found whining that his tools are not right. If a moulder must ever, for the accommodation of others, undertake to produce castings under circumstances which do not warrant success, when the pattern is not right, or the time is too short, let him do so under the most explicit protest, while refusing all responsibility, and let him seldom be weak enough to comply, even as much as that. As a rule, insist like a man upon having things right and take a man's hearty pride in successful achievement.

I happen to have known of very many consultations between pattern maker and moulder. The moulder says that the thing can't be made. The pattern maker goes to the foundryman and shows him how to make it and the foundryman is "effectually silenced." Does not the foundryman re-

member many an incident of that character? Then the foundryman acknowledges that the most important item of foundry management—the selection of iron—in three-quarters of all the foundries in the country, is in the hands of men who either do not know, or do not care, and their economy in the purchase of iron damages the product at least twice a year. Isn't that putting the foreman's statement even stronger than he put it himself?

The foundryman finds the climax of his defense in the pitiful excuse that sometimes the draw irons don't fit. To this, of course, when seriously offered as an apology for the bad castings, which day by day embitter the foreman's life, no answer can be offered. We all know that if a draw iron does not fit, no decent castings can be made. I once got up a fine metal pattern, finished in the highest style of art and fitted with a pair of the most exquisite draw irons, and took it to the foundry. A few days after, I called for my casting, and I found that the moulder had thrown away my draw irons, and used a ten-penny nail to draw the pattern with, so I can very well appreciate a moulder's remarks about draw irons.

Of course, it is not necessary to prolong the recrimination; the case was bad enough before the foundryman stood up and confessed, as the foreman bade him. I know that he may safely consider himself forgiven. The great question is: What are we going to do about it? The machinist and the pattern maker have not been blameless, but they have been improving, and if to-day we get better castings than we did a quarter of a century ago, it is certainly as much by their aid as by that of the moulder. I am individually learning daily more and more of the importance of precision in patterns. Labor bestowed on them is saved a hundred-fold in the castings. And if any one will look over the pattern lofts of the best establishments he will find that all are learning the lesson.

Let the moulder brace up and show us his improved methods and added facilities; let him get up a better system of flask building, so that the flasks can be more readily adapted to the various patterns as they come along, and so that a 7×9 foundry will not need a ten-acre lot for a flask yard. Let him go to some Bessemer steel works and learn how to handle the molten iron without breaking his precious back. Let him do something; let him do anything to show that he lives in the present century; and as we are getting near the end of it, he will have to hurry up.

FRANK H. RICHARDS.

Troy, N. Y., Dec. 20.

Case-Hardening Mixture.

Editor American Machinist:

The method of case-hardening small iron articles in a bath of equal parts of fine salt and cyanide of potash, mentioned by W. S. Harris in the AMERICAN MACHINIST, Jan. 1, is excellent, as my own experience has proved. The addition of a small piece of rosin to the mixture will make the articles come out cleaner and neater than they otherwise would. The hardened surface may be made as thin as a sheet of paper or as thick as desired, according to the length of time the articles remain in the bath. It should be observed that the fumes of cyanide of potash are very poisonous, and care must be taken not to inhale the least portion of them.

O. P.

Worcester, Mass.

Fast Screw Cutting.

Editor American Machinist:

T. H. Pollard, of Plainfield, N. J., seems to doubt the time made on screws. The screws were of iron and of the meanest quality. For the depth of thread he will have to apply to the patentees of the press. The screws are for packing cotton. They were not of the finest finish, but fine enough for the work they had to do. I have two brothers that make as good time as I do, and I believe one of them has beaten me by two minutes.

ANDY D. HOWARD.

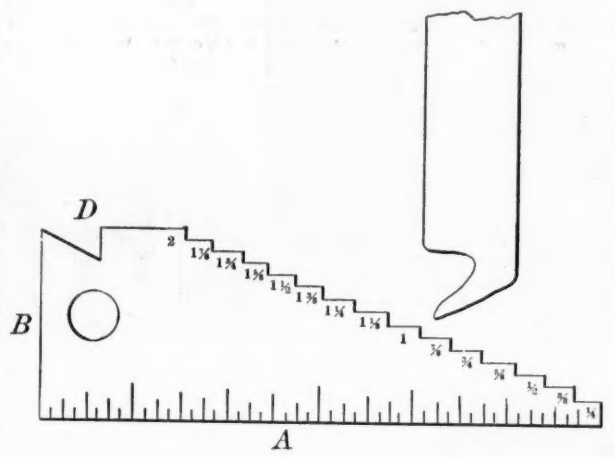
Graniteville, S. C.

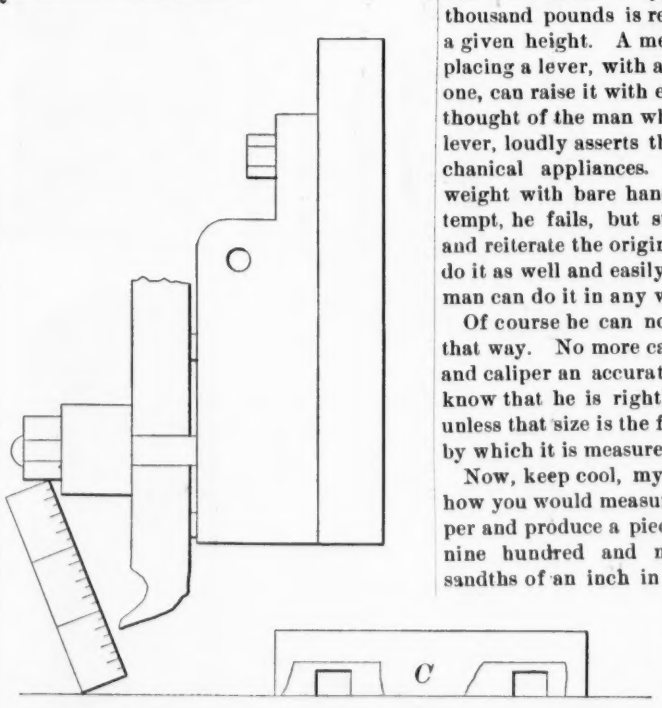
Benefits of Standard Gauges.

Editor American Machinist:

On seeing my scribbling in print, methinks I hear some one say, "What cheek! Don't that Pittsburgh man know that thousands of men have been practicing, for years, what he treats as his own discovery?"

"Don't he know that besides micrometer and vernier calipers, there are measuring machines and sets of internal and external gauges guaranteed to indicate, or to be within the twenty-five thousandth part of an inch of any required size?" Does some Yankee apprentice with a shop experience of less weeks than I have had years, at whose feet I might sit as a pupil ask, "What's he giving us?" Aye, aye, full well he knows—and thankful he is that so many have already adopted the admirable means for making so close measurements as to produce interchangeability, which, although sneered at, and called by some impossible, has been the foundation for some of the most successful manufacturing operations. Thankful also is he that some of the best mechanics in this country, who have advanced step by step from the rank of apprentice, through all the routine duties of machine building to the proprietorship and management of immense concerns, employing thousands of men, are spending astonishing sums of money to still further improve the already wonderful appliances. Thankful too is he that in these later days there is such an amount of valuable practical information laid before all who will read, by the many scientific and mechanical journals, among which none is more welcome to him than the AMERICAN MACHINIST.





Perhaps I am accused of an attempt to advertise the micrometer caliper. I certainly have no interest pecuniarily in so doing; and if, in effect, it is advertising, it is not through solicitation. If the introduction of a system of actual measurements in place of guess-work—of facts in place of mere opinions—would confer a private benefit, I claim that to bring the thousands of mechanics to the light, who are to-day measuring in the old way, with rule and caliper, would be a public benefit a thousand-fold greater than any private gain on the part of manufacturers of the advertised instrument.

Scarcely a day has passed in more than twenty years in which I have not been used to measure with either the vernier or micrometer caliper, or worked by templates produced by such measurements. During this time I have been continually brought in contact with mechanics, some of them really excellent workmen, who, refusing to examine the means adopted for measuring in thousandths, boast of their ability to measure with steel rule and caliper, and transfer to their work any given size, as accurately as can be done with vernier or micrometer. They "don't know anything about the new-fangled humbug, and don't want to." These men affect to hold all men who assume that close measurement means within less than the one-thousandth part of an inch in the utmost contempt. Should several pieces of their work, which were intended to be of exactly some given size, be examined, the variation found from size required, or from each other as well (provided that no one of the pieces was used by which to make any of the others), would warrant the belief that the same feeling of contempt extended to small fractions of an inch.

Having known many conversions, and never a case of "falling from grace," I have been casting about for an illustration of the position of those still "out of the fold," which may lead them to see themselves as others see them. Suppose a weight of two thousand pounds is required to be lifted to a given height. A mere child, by properly placing a lever, with advantage of forty to one, can raise it with ease. What would be thought of the man who, casting aside the lever, loudly asserts that he wants no mechanical appliances. "He can lift the weight with bare hands." Making the attempt, he fails, but still continues to tug and reiterate the original statement, "I can do it as well and easily my way as any other man can do it in any way."

Of course he can not lift the weight in that way. No more can he make with rule and caliper an accurate measurement (and know that he is right) of any given size unless that size is the full length of the rule by which it is measured.

Now, keep cool, my friend, and tell me how you would measure with rule and caliper and produce a piece to order precisely nine hundred and ninety-nine one-thousandths of an inch in diameter. You can only do it by accident. Should you chance to get the exact size, your way of measuring leaves you in ignorance of the fact. Are you ready to admit that you cannot make such an unheard-of measurement?

I contend that you can make it just as well as you can the familiar halves, quarters, eighths, sixteenths, thirty-seconds and sixty-fourths. The way you measure is (within a range of variation, differing with different degrees of skill, keenness of eyesight, sufficiency of light, etc.) guess work; a mere opinion as to when the points of calipers agree with certain lines on a rule. I have many times known the opinion of good workmen as to what constituted a given size, to be "off" a sixty-fourth, or even a thirty-second, of an inch. With these fractions put thus: 0.015625″=$\frac{1}{64}$, 0.03125″=$\frac{1}{32}$; or, in shop parlance, fifteen and five-eighths-thousandths, and thirty-one and a quarter thousandths respectively, and an instrument with which to measure, by which an apparent variation of from one twenty-fifth to one-sixteenth part of an inch makes in reality but one one-thousandth of an inch, and the application of the illustration is complete.

Is it supposed to be difficult to understand or operate this instrument? Nothing could be more simple. Printed tables of decimal equivalents can be had, covering the usual divisions of an inch; while, without the tables, a very simple mental process soon brings to the tongue's end all that is required. For dollars, dimes, cents and mills, simply substitute inches, tenths, hundredths and thousandths.

S. W. GOODYEAR.

Pittsburgh, Pa.

The Largest Milling Machine.

Editor American Machinist:

In your issue of Jan. 15, under the head of "Manufactures," there is an account of a machine just completed by Cox & Prentiss, of Cleveland, O., supposed by them to be the largest milling machine in the United States. As there are no dimensions given of this machine, I think, perhaps, there may have been, and still is, in use a larger one.

In the year 1870, the Pratt & Whitney Co., of Hartford, Conn., built for the Tilton & McFarland Safe Co., of New York, a milling machine, for shaping safe doors. This machine weighed 17 tons, would mill work up to 3″ wide and 9 feet long, and was capable of making a cut 6″ wide, one foot deep, on a combination of iron and steel. This machine is now in use by the Continental Iron Works, of Greenpoint, L.I. If the machine built by Cox & Prentiss is larger than this one, it is entitled to the palm.

JOHN J. GRANT.

Hartford, Conn.

A Planer Gauge.

Editor American Machinist:

Among the useful tools for the planer the gauge shown in the accompanying sketch should have a place. It is a piece of saw plate 6″ long and 2″ wide, straight on one edge and cut into steps of an eighth or sixteenth rise on the other. The steps are to set the tool by on the last cut.

Sometimes a scale (unless a very short one) cannot be used, as the strap or post is in the way. Cut and try is the only plan then.

The sketch shows this difficulty. Suppose the block *C*, is to be planed ⅛th thick. It is then evident that the gauge is the best thing to set the tool with.

This affair might be made a combination tool; the lower edge *A*, marked like a scale. With *B* it would form a try square. The notch *D*, in the upper corner, is for a screw-tool gauge.

The hole is for convenience in hanging it on a watch chain.

I shall claim a patent on the hole, "substantially as and for the purpose set forth."

Who will make us some of these gauges of standard size?

G. THOMPSON.

Keeseville, N. Y.

The *Lowell Courier* says: "We hear of a grocer who calls his scales 'ambush,' because they lie in weight."

A two-foot rule was given to a laborer in a Clyde boat yard to measure an iron plate. The lumper not being well up to the use of the rule, after spending a considerable time, returned. "Noo, Mick," asked the plater, "what size is the plate?" "Well," replied Mick, with a grin of satisfaction, "it's the length of your rule, and two thumbs over, with this piece of brick and the breadth o' my hand, and my arm from here to there, bar a finger."

Track laying has been commenced on the Eastern Tennessee and Western North Carolina road, which is to run from Johnston, Tenn., eastward to the Cranberry iron estate, in North Carolina, a distance of 32 miles. All the grading is completed or under contract.

Railroad Building During 1880.

The Railway Age, in its issue of January 6, gives the railroad construction of 1880, in detail, by States and by companies and divisions under each State and Territory-heading. The summary is as follows:

STATES.	No. LINES.	MILEAGE.
Arkansas	4	70.00
Alabama	1	20.00
Arizona	1	200.00
California	1	3.00
Colorado	13	401.50
Connecticut	1	35.70
Dakota	13	680.85
Delaware	1	1.00
Florida	2	36.00
Georgia	5	56.50
Illinois	12	342.06
Indiana	8	161.00
Iowa	19	445.39
Kansas	10	344.50
Kentucky	1	17.00
Louisiana	2	97.20
Maine	1	3.00
Maryland	2	41.11
Massachusetts	5	46 44
Michigan	10	288.75
Minnesota	6	119.60
Missouri	8	257.75
Montana Territory	1	65.50
Nebraska	10	385.40
Nevada	2	60.00
New Jersey	4	56.90
New Mexico	5	519.65
New York	3	41.34
North Carolina	3	42.00
Ohio	13	525.00
Oregon	4	206.50
Pennsylvania	16	205.72
Rhode Island	1	7.00
South Carolina	3	31.00
Tennessee	3	24.00
Texas	13	658.80
Utah	3	85.22
Vermont	1	36.00
Virginia	4	247.00
Washington Territory	2	81.00
West Virginia	2	26.00
Wisconsin	15	235.84
Totals	234	7,207.31

These figures are submitted as being incomplete and subject to modification by later returns. In the following table of comparative railway progress, from 1871 to 1831, the figures, except those for 1880, are from *Poor's Manual*:

Years	Mileage added.	Total in U. S.
1871	7,379	60,283
1872	5,878	66,171
1873	4,107	70,278
1874	2,105	72,283
1875	1,712	74,096
1876	2,712	76,808
1877	2,281	79,089
1878	2,687	81,776
1879	4,721	86,497
1880	7,207	93,704

In commenting upon this remarkable increase of mileage, *The Railway Age* says:

These figures are far greater than those for any year since 1871, and the mileage is more than 54 per cent. greater than that built in 1879. We have no doubt that the final figures will increase it to at least 7,500 miles, which is a greater mileage than has been constructed in any previous year in the United States or, of course, in any other country. Our table shows that the work of construction has been prosecuted in forty-two of the States and territories, the only State not included in the list being Mississippi, and the only territories not given being Idaho, Wyoming, Indian territory—from which railways, eager to enter, are still forcibly kept out—and ice-bound Alaska, which is at present beyond the reach even of the most enterprising railway builder. Work is now actively in progress in both Idaho and Wyoming, and another year will see large additions in these territories also, while the Indian country will doubtless be opened to several new enterprises.

It should also be borne in mind that the figures show only the track reported, and do not include the vast mileage upon which grading has been in progress, and which will be ironed in the coming year. It is not unlikely that ten thousand miles of road will be added in 1881!

If we assume the cost of building and equipping the 7,207 miles here reported laid, we find that the enormous amount of over seventy-two million dollars has been expended on these completed roads. How much more has been spent in surveys and construction on other new lines, it is of course, impossible to say.

Newly-Incorporated Companies.

NEW YORK.

Blanchard Furnace and Steam Engine Company, New York. V. W. Blanchard, Henry B. Sisson and others, incorporators; Capital, $3,000,000, in shares of $100 each. For the manufacture and sale of furnaces, steam engines and other machinery, and fuel for useful purposes in the arts. Jan. 11th.

The American Underground Cable Company, Long Island City, N. Y. Solomon Hanford, Chas. M. Dodge and others, incorporators; Capital, $1,000,000, in shares of $100 each. For the manufacture and sale of electric cables and wires, and the machinery necessary for such manufacture, and the purchase of such patents and licenses as may be necessary in connection with the same. Jan. 12th.

Portable Fountain Water Closet Company, Limited, New York. Martin R. Fory, Robert B. Hull and others, incorporators; Capital, $50,000, in shares of $50 each. For the manufacture and sale of portable fountain water closets. Preliminary certificate filed Jan. 8th.

Howard Manufacturing Company, New York. John E. Reed, Robert H. Kellock and others, incorporators; Capital, $5,000, in shares of $25 each. For the manufacture and sale of sundries for the dry goods, notion, hardware, stationery, drug and other branches of trade. Jan. 10th.

The Embossed Sign Company, New York. Solomon Heyman, Louis Schuler and others, incorporators; Capital, $10,000, in shares of $100 each. For the manufacture and sale of embossed and lettered glass signs. Jan. 11th.

The East Long Island Pottery Company, Sag Harbor, N. Y., Frederick Wood, Peter C. Petrie and others, incorporators. Capital $50,000, in shares of $25 each; for the manufacture and sale of pottery, crockery, china, tiles and earthen ware of every description. January 4th.

"Central City Knife Company," Phoenix, Oswego County, N. Y. Wm. Spaulding, J. I. Van Deusen and others, incorporators. Capital $10,000, in shares of $50 each; for the manufacture and sale of cutlery. January 5th.

Edwin Reed Manufacturing Company, New York. Alfred Fellows, Russell H. Robins and others, incorporators. Capital $60,000, in shares of $100 each; for the manufacture and sale of type-writing machines and other implements and apparatus for telegraph and other uses. January 5th.

United States Hevernoid Company, New York. Adolph Pappenhusen, Henry Gerner and others, incorporators; Capital $300,000, in shares of $100 each. For the manufacture and sale of the material and product known as hevernoid. Jan. 6th.

Kittle Spring-Bed Company, New York. Thomas B. Harrison, Samuel L. Kittle and others, incorporators; Capital $500, in shares of $50 each. For the manufacture and sale of spring beds, mattresses and bedding. Jan. 6th.

The Bradley White Lead Company, New York. C. T. Raynolds, Wm. Tuttle and others, incorporators. Capital $250,000, in shares of $100 each. For the manufacture and sale of white lead, red lead, litharge, etc. Jan. 6.

American Acetate of Lime Works, Conklin, Broome County, N. Y. George C. Edwards, Charles E. S. Holmes and others, incorporators; Capital $20,000, in shares of $25 each. For the manufacture and sale of pyroligneus and acetic acids, acetate of lime, wood, alcohol and charcoal. Jan. 7th.

The Auto Organ and Piano Company, New York. Cornelius J. Vanderbilt, Scott Lord and others, incorporators; Capital $20,000, in shares of $100 each. For the manufacture and sale of musical improvements, under patents issued to Wm. W. Bennett and Geo. H. Chumock. Jan. 7th.

The International Fertilizer Company, New York and Canada. Rob't. E. McBride, Geo. H. Bacon and others, incorporators. Capital, $30,000, in shares of $100 each. For the manufacture and sale of fertilizers, and to do all things incidental to said business.

Crown Carpet Lining and Oil Cloth Company, limited, New York. Henry Hayward, George C. Lyman and others, incorporators. Capital, $200,000, in shares of $25 each. For the manufacture and sale of carpet lining and oil cloth. Preliminary certificate filed Dec. 31, 1880.

Bainbridge Shoe Company, Bainbridge, N. Y. J. M. Curtis, Elliott Danforth and others, incorporators. Capital, $2,000, in shares of $25 each. For the manufacture and sale of boots and shoes.

The Westport Pulp Company, of Westport, Essex county, N. Y. Aaron Clark, M. A. Clark, and others, incorporators. Capital, $10,000, in shares of $100 each. For the manufacture and sale of pulp and paper from wood. Jan. 3, 1881.

The Winters Fire Apparatus Company, New York. Joseph R. Winters, William G. Reed, and others, incorporators. Capital, $200,000, in shares of $100 each. For the manufacture and sale of Winters' improved patent fire escape, ladder and hose conductor. Jan. 1, 1881.

Sharkey's Monument Works, Brooklyn. James Sharkey, Conrad Meister, and others, incorporators. Capital, $75,000, in shares of $100 each. For the manufacture of monuments, statuary, fountains, and marble, granite and stone for building purposes. Jan. 1, 1881.

The De La Vergne and Mixer Refrigerator Company, New York. John C. De La Vergne, Wm. M. Mixer and others, incorporators; Capital, $350,000, in shares of $100 each. For the manufacture and sale of machinery and apparatus for cooling beer and other substances, for making ice, and for other refrigerating purposes.

The Northampton Slate Company of Bangor, Pa., New York. Chas C. Cakefair, Frank L. Wing, and others, incorporators; Capital, $150,000, in shares of $100 each. To quarry and manufacture slate and to deal in the same, and to transact all business that may be incidental or collateral to the slate industry.

The Mutual District Messenger Company (Limited), New York. Geo. V. D. Frost, Peekskill, John D. Haynes, of New York, and others, incorporators; Capital, $6,250 in money, in shares of $25 each. Filed Jan. 3, 1881, for the purpose of transacting a general messenger, telegraph, express and telephone business in the city of New York and vicinity.

The Pioneer Telegraph Company. Chas. J. Wiley, of New York City, Chas. M. Harris, of Astoria, and others, incorporators; Capital, $1,200, in shares of $50 each. To construct, maintain and operate a line of telegraph, extending from the city of New York, north to Albany, east to Brooklyn and Long Island City, and west to Newark, N. J.

The Salamanca & Warren Railroad Company. Walston H. Brown, Henry K. Southwick and others, incorporators; Capital, $220,000, in shares of $100 each; to construct maintain and operate a railroad, commencing in the village of Salamanca, New York State, and running thence by the most direct route to or near the point where the Allegheny river crosses the line between the States of New York and Pennsylvania. Length of road about twenty-two miles. December 27.

New York Electric Light Association, New York. Wm. M. Lendrum, Leo Daft and others, incorporators; Capital, $300,000, in shares of $100 each; for the manufacture and sale of certain inventions and discoveries in electric lighting, and articles in connection therewith and appertaining thereto. December 28.

New York Diamond Millstone Dressing Company, New York. Simon Dessan, David S. Dessan and others, incorporators; Capital, $5,000, in shares of $50 each; for the manufacture and sale of diamond dressers for millstones. December 28.

MASSACHUSETTS.

G. W. & F. Smith Iron Company, Boston. George W. Smith, President; Franklin Smith, Treasurer; Capital $124,000, in shares of $100. For manufacturing and dealing in all kinds of wrought iron, cast iron and metal works and business incidental thereto.

The Boston Copper Mining Company, Boston. Edward B. Earle, President; Geo. D. Eldridge, Treasurer; Capital $50,000, in shares of $100 each. For mining, smelting and milling copper and other ores in Charlotte County, Province of New Brunswick, or elsewhere, and the preparing of the product of the same for market.

Fairchild Paper Company, Boston. Chas. Fairchild, President; Francis W. Palfrey, Treasurer; Capital $350,000, in shares of $100 each. For the manufacture of paper.

Wright Machine Company, Worcester, Edward Wright, President; J. Walter Smith, Treasurer; Capital $12,000, in shares of $100 each. To manufacture and sell machinery, tools and implements.

Berkshire Overall Company, Pittsfield. John S. Wolfe, President; George W. Pease, Treasurer; Capital $5,000, in shares of $100 each. For the manufacture and sale of overalls, clothing and materials for making same.

Readers' and Writers' Economy Company, Boston. Wm. F. Slocum, President; Winfield S. Slocum, Treasurer; Capital $5,000, in shares of $100 each. For the manufacture, testing and dealing in all articles used by all who read and write.

Boston and Breckinridge Smelting Company, Boston. Wm. H. Reynolds, President; S. P. Wardwell, Treasurer; Capital $75,000, in shares of $100 each. For the buying, selling, smelting, working and dealing in gold, silver and other ores and incidental business.

Gloucester Isinglass and Glue Company, Gloucester. Charles W. Dennison, President; John S. Rogers, Treasurer; Capital $13,600, in shares of $100 each. For the manufacture and sale of isinglass and glue.

PENNSYLVANIA.

The J. Barton Smith Company, Philadelphia. Charles F. Cripps, Gilbert Parker and others, incorporators. Capital, $50,000, in shares of $100 each. For the manufacture of files, rasps and other hardware. Jan. 6.

Conewago Iron Company, Middletown. Paris Haldeman, Horace L. Haldeman and others, incorporators. Capital, $60,000, in shares of $100 each. For the manufacture and sale of iron, and the mining and sale of iron ores. Jan. 6.

Dent Oil Company, Oil City. Wm. S. McMullan, Hugh L. McMullan and others, incorporators. Capital, $5,000, in shares of $10 each. For acquiring petroleum lands, mining, manufacturing, transporting to market, and selling petroleum. Jan. 7.

The Montana Coal Company, Mauch Chunk. Elisha A. Packer, Austin H. Church and others, incorporators. Capital, $50,000, in shares of $50 each. For mining, shipping to market, and selling anthracite coal. Jan. 11.

Steam on Canals.

In speaking of steam propulsion and cable towing, the Auditor of the New York State Canal Department, in his recent annual report, says:

The construction of the Baxter boats, defective as they proved to be, attracted the attention of other builders and inventors, and the number of boats propelled by steam on the canals of this State during the last season was larger than any year previous. The fact that these boats, which cost more than boats towed by horses, are increasing in number, would seem to indicate that they are a profitable investment. There is still room for the inventor, and the relative value of the two systems of propulsion is an unsolved question.

In 1871 a company was formed to introduce upon the canals of this State "Cable Towing," or the method generally known as the "Belgian System." About 120 miles of cable have been laid, which has been in operation during the last season. The results this year have not justified the expectations of the friends of the system. Many complaints have come to this department from boatmen, and others interested in the business of the canals. The burden of these complaints was that the system interferes with the passage of boats and seriously obstructs navigation.

The Bucyrus Foundry and Manufacturing Company (Ohio Central Railroad machine shops) has been incorporated at Columbus, O., with a capital stock of $100,000.

It is announced that the Cincinnati Street Railway Company controlling the street railway system of Cincinnati, contemplate introducing the wire-cable system in use in San Francisco, doing away with horses. The cable runs under ground, on the endless-chain system, and is operated by stationary engines. It is to be tested in Gilbert avenue, and if found practicable, used generally.

Krupp is now making railroad rails instead of big guns. However, he can have the satisfaction of knowing that a great many people are killed every year by railroad accidents.

An iron and steel institute is likely to be organized in Germany, after the plan of the British Iron and Steel Institute. A meeting with this end in view has lately been held at Dusseldorf.

Sixteen thousand five hundred dollars have been subscribed at Jefferson, Texas, for building a cotton factory.

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NEW YORK, JANUARY 29, 1881.

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The printed date on each wrapper shows the time to which the subscription is paid. We discontinue the paper in all cases when the time paid for has expired, unless renewed.

Accepting Orders on Long Time.

As indicated by the items from machinery establishments in our columns from week to week, it is not unusual for orders to be accepted for delivery three, six or even twelve months from the time they are entered. Most manufacturers have become accustomed to take all good orders that are offered, with the agreement to execute them on or before some specified time. This plan could not be open to any serious objections until, as now, business becomes extraordinarily brisk and orders can be taken to keep shops driven to full capacity for many months ahead. The allurements of a superabundance of orders are likely to induce, in many cases, a departure from ordinary prudence in calculating the cost of production for the future. Shop owners can figure up almost to a certainty what it will cost to manufacture their regularly built machines at the present time, but none of them can mark out, with safety and assurance, what the cost of the same machines will be six months hence. Labor and material may advance fully one-half, thus scattering the most confident anticipations, and perhaps carrying the supposed margin of profit on long-time contracts over to the other side of the ledger. The longer ahead orders are taken for execution the greater the uncertainty of making respectable profits, or of making any profit at all.

Unexpected mishaps occur in shops which seriously delay work promised at a certain time. A few days since a machine-tool manufacturer remarked to us that his whole shop had been kept idle five weeks within the last three months, by reason of troubles—first with the boiler and then with the engine. The boiler had to be taken out and repaired; then the engine got out of line, cut its cylinder, and had to be taken apart, repaired and lined up. Many orders had been taken to be filled within that time, but those giving them and relying upon promises of their being executed in time, had to suffer disappointment. The result was the loss of several good customers, who would not accept excuses. This machine-tool builder expressed his determination to take no more orders for delivery any long time ahead.

Some may display excess of conservatism in taking risks in the way of future contracts, but it is best to consider possible changes in prices and accidental hindrances before accepting orders for any considerable time.

A Boiler Explosion Caused by Carelessness.

One of the most terrific boiler explosions that has taken place for many months occurred at the smelting works of E. Balbach & Sons, Newark, N. J., Jan. 6, 1881, killing four men, besides doing great damage to buildings and property. There were three boilers connected to a steam pipe by means of a valve upon the top of each boiler, so that by closing the valves all communication with the boilers, safety valves and steam gauges, was cut off. The manner in which the explosion occurred was as follows:

The gasket on the man-hole plate in one of the boilers leaked badly. The valve upon the top of the leaky boiler was closed, in order to renew the joint. After this task was accomplished, the valve was opened. Through some unknown cause, the night engineer, who was killed, shut the valve. There was, therefore, no way of telling how much pressure was in the boiler. However, steam accumulated until an explosion occurred, destroying another boiler and doing the damage alluded to; after which the valve was found closed. The cause was simply carelessness in closing a valve which should have been allowed to remain open.

The spring meeting of the American Institute of Mining Engineers is announced to open in Philadelphia for a two or three days' session on Feb. 15, next. It is understood that, as yet, the programme has not been fully mapped out. A number of interesting papers will doubtless be read, and several industrial establishments visited.

Boiler Plate Designations.

The boiler plate manufacturers east of the Alleghanies have held a meeting and very wisely concluded to drop the cabalistic designations heretofore applied to the different grades of plates, as per following resolutions:

Resolved, 1st, That on and after Jan. 15, 1881, the letters *C No* 1 be dropped in stamping plate iron and the word *Refined* be substituted therefor.

Resolved, 2d, That on and after Jan. 15, 1881, the letters *C H No* 1 and *C H No* 1 *Shell*, now being used in stamping plate iron, be dropped and the word *Shell* be substituted therefor.

Most of the mills agreed to the change, and we understand it is to be generally accepted. No change, however, was made in the designation of flange iron, which will be as heretofore, "C H No 1 Flange."

Originally the best boiler plate for shells was stamped "C No 1," and the next grade "C No 2," the "C" standing for charcoal. In the course of legislative innovations, manufacturers of plates for marine boilers were required to stamp the grade called for as a standard by the Navy Department, "C H No 1." From that time the "C No 1" brand has been used for the second grade. But the same grade from different mills does not always mean the same quality; moreover, a great deal of the plate made and sold with a capital "C" stamped upon it has very little charcoal iron in it. Dealers and boiler makers have sometimes ordered an inferior quality of plates and had them stamped with the mark of a higher grade.

The only safe way to get reliable boiler iron is to buy plates bearing the private stamp of a reliable mill as well as the designation of the grade. Those who order boilers would also do well to remember this fact.

Mexican Opportunities.

The civilizing and restraining influences, which are now beginning to act effectively in Mexico bid fair, at no distant date, to open up to the adventurous shop proprietor and mechanic a valuable and growing field. General Furioso and General Ponderoso, having ceased to raise the monthly standard of revolt, because held in check by the forces of a rising civilization, will henceforth have an opportunity to distinguish themselves in more useful, even if less brilliant, directions.

Order once fairly assured, the ever-ready enterprise of our own people can safely be relied upon to discern and to occupy the coming vantage ground of Mexican opportunities for railway, mining, manufacturing and mercantile success.

The World's Fair Muddle.

It is greatly to be regretted that the differences which, it was supposed, would be settled by the choice of the Inwood site are still unsettled, with a prospect of remaining so indefinitely. The time in which the Commission can settle the existing difficulties, and organize out a successful exhibition is now so short that it will soon be doubtful whether harmony among its members even can place the enterprise upon a sure footing. The stipulation that the persons who furnish the funds shall have such sufficient voice in directing expenditures, as will secure a wise and proper outlay, is eminently practical and just, and it is to be hoped the Commission will be organized speedily, or reorganized if necessary, with this end in view.

If the steps necessary to be taken, in order to successfully open the exhibition in 1883 on the day named, cannot be taken in season, we believe the public will agree substantially to drop the sentimental considerations that connect this exhibition with the hundredth anniversary of the acknowledgment of the independence of the United States, and re-organize the enterprise for some practicable, later date, say, the summer of 1885. By all means let us have either a square-toed, successful exhibition, or adjourn the enterprise to a date that will put it beyond the reach of failure.

Study of Foreign Specialties.

Just now, many ambitious mechanics are thinking of going into business for themselves, an aspiration eminently suited to the times. Of these, it is safe to say, that a considerable proportion will turn their attention to the invention and production of useless devices. Another proportion will set up in opposition to houses permanently intrenched in special lines by force of long experience, accumulated capital, and special appliances for manufacture. Seeking the same market in competition with such establishments, cannot be other than up-hill work for a beginner. Another proportion of the new aspirants to industrial success, will wisely go West or South, and seek for green fields and pastures new, in which to establish themselves and obtain a home market.

Now, there can be little question that there are many specialties made extensively abroad, which are produced to but slight extent in this country. Many of these specialties are small articles, which are to more ambitious lines of machinery production, what a needle or fish-hook is to a steam engine; but, happily, the size of a product does not, necessarily, govern its sale. Doubtless, good judgment will be requisite in this, as in most matters; but, perhaps, one of the most useful suggestions that can be made to such mechanics is, to call attention to the results that may, in time, come from the diligent study of foreign specialties, with a view to making them in this country by means of hard work and improved tools.

Influence of Climate on Manufactures.

The sturdy effort towards manufacturing independence which Canada is now making, under the influence of her new protective tariff, finds a notable counterpart in the present status and industrial prospects of our Southern States. The scattered and limited population of the Dominion, hampered in some respects by the rigors of the climate, while arousing the hostile criticisms of England, by what is there regarded as an ungrateful return for past and prospective kindness, is steadily laying the foundations of solid industrial prosperity. But it should not be forgotten or overlooked that even an extremely cold climate has its advantages, in the case of an isolated country like Canada, under a protective tariff. Many articles of apparel and house-furnishing are required by the people, in consequence of the climate, to a much greater degree than would be the case in a warmer country. Houses, too, must be made warmer, and buildings must be better sheltered from wintry blasts. All of these things, while they may not afford Canadian manufacturers equal advantages in supplying other countries, suffice to give them more business at home than an equal population elsewhere would require.

In the Southern States of this country, however, widely different conditions obtain. The promoters of home manufactures in those States, while shielded from competition with the poorly paid labor of Europe by a protective tariff, find themselves brought into square competition with the older manufacturing States, and must tug for a foothold. But their warm climate must inevitably afford our Southern States important advantages which are peculiarly their own. The well-established position of those States as a cotton-growing region affords a good basis for prosperity in cotton manufacture, while the lessened cost of living, due to the mild climate, if it does not make these States in the near future a favorite abode for workingmen, can certainly be expected to influence the cost price at which cotton goods, and many varieties of general manu-

factured goods, can be produced, with reference to supplying foreign markets. In this connection, the industrial history of India is a case in point. The statistics of machine-produced wares in Hindostan show a very rapid increase in recent years, approximating an amount quite sufficient to affect the markets of the world. Nor can it be said that the ignorance and heathenism of the operatives of that country account for the low rates at which labor can be obtained. The warmth of the climate, the fertility of soil, which usually accompanies such climates, and the correspondingly low cost of living, are positive advantages, which not even the accumulated burdens of ignorance, heathenism, bad business management and centuries of misgovernment can wholly weigh down.

Mr. Frank D. Heath, mechanical engineer for the Hancock Inspirator Co., died Dec. 13, 1880, after an illness of about ten days. Mr. Heath was born in Manchester, N. H., in March, 1846. After graduating from the Academy at Corinth, Vt., he entered the machine shop of the Amoskeag Manufacturing Co. at Manchester, N. H., where he learned the trade of machinist. In 1872 he became associated with Mr. John T. Hancock, the inventor of the Hancock Inspirator, and rendered him valuable assistance in the perfecting of the Inspirator. Upon the organization of the Hancock Inspirator Co. he entered their service, and at the time of his decease was their mechanical engineer. Mr. Heath had made a special study of jet apparatus, in which branch he was considered an "expert." He had many friends among the prominent mechanics and engineers of this country.

The American Stock and News Telegraph Company has just been organized with George A. Stanton and James Owen, of New York City, and others, incorporators; Capital, $1,000,000, in shares of $100 each. Capital may be increased to $10,000,000. To construct, maintain and operate a line of telegraph, extending from New York, north and west to Albany and Buffalo, and east to Brooklyn and Greenpoint, and west to Newark, N. J.

QUESTIONS & ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly and according to common sense methods.

(1) I. G. B., Fremont, Ohio., asks: What is the power of an engine 3½"x 5" running 150 revolutions per minute with a boiler pressure of 90 pounds? What size governor would do for such an engine? *A.*—About 1 3-5 horse power. The governor should be suitable for ¾ inch pipe fittings.

(2) L. O. C., Sedalia, Mo., asks: I desire a rule to find the proportion for cylinder steam ports for stationary steam engines, also to find the travel of valve, the proper lap inside and out besides the throw of eccentric. *A.*—To find the area of port, multiply the square of the diameter of the cylinder in inches by half the speed of the piston in feet. Multiply the product by 4 and divide by 10,000; this will give a good liberal port. The travel of valve is equal to the outside lap on one end of the valve added to the width of port multiplied by 2; if the eccentric is connected direct to the valve stem its travel should equal this amount. The amount of outside and inside lap depends entirely upon the point of cut-off and the amount of compression that is desirable. By consulting the AMERICAN MACHINIST for Dec. 6, 1879 and Feb. 14, 1880, you will find diagrams, and directions how to construct them to obtain the proper amount of lap for any point of cut-off.

(3) R. G., New York City, asks: 1. Why do engineers say 27 or 30 inches of vacuum instead of lbs.? *A.*—The old fashioned vacuum gauge was composed of a U shaped pipe into which was poured a sufficient amount of mercury; one end of the pipe was connected to the condenser, while the other end was open to the atmospheric pressure, consequently when a vacuum is formed in the leg, between the mercury and condenser, the mercury column rises in the glass tube and indicates the amount in inches, which can be readily converted into pounds pressure: 2.04 inches of height of mercury, being equivalent to 1 pound. Although modern mercury gauges are differently constructed, the old nomenclature is still retained. 2. Where is the most pressure in a boiler? If in the leg why do they tap the steam drum for a steam gauge—sometimes using 30 or 40 feet of pipe for fire room gauge, when by tapping in leg two or three feet from bottom, all this pipe would be saved? *A.*—Fluids when confined as in a steam boiler press alike in all directions, consequently there is a uniform pressure on all parts of a boiler under a pressure of steam. The steam gauge pipe is connected to the highest part of a boiler principally to avoid scale and sediment; moreover the higher the point where the pipe enters the boiler the less trouble will be experienced from the pipe becoming obstructed. In many cases more pipe is used than is necessary through carelessness or stupidity. A gauge pipe should be as short as possible to answer the desired purpose.

(4) R. R. G., Ontario, writes: 1. I find that a tubular boiler, say about 14 feet long and about 40 inches in diameter, gives out in a very short time, in fact I do not believe they will last one-third the time a boiler 12 feet long and the same in diameter. Will you please tell me why? *A.*—We can readily understand why a long boiler is subjected to more wear and tear than a short one, from strains and unequal expansion; but we think that your illustration shows too great a discrepancy. In your experience you must have met with some practical examples for which you can furnish us more definite results, which will enable us to arrive at a reliable conclusion. Please send us all the information you can in reference to style of boilers in cases that you refer to, also the kind of material used in their construction—which differs greatly and may be the sole cause of the difference in durability. 2. Will you tell me how a boiler may be burnt when there is plenty of water in it? I very seldom find an engineer that will acknowledge he has let the water get low. *A.*—We saw an example recently where a boiler was burnt in two places directly over the furnace which was caused by a deposit of sediment, there being plenty of water in the boiler at the time of the accident. In this particular boiler the feed water was taken from a surface heater in which the exhaust steam came in contact with the surface of the feed water, and was partly condensed. All the dirt and oily substances from the engine cylinder were thrown into the heater mingled with the water. The feed pipe was attached to the bottom of the heater, consequently the sediment was forced into the boiler where it was precipitated, preventing the water from touching the plates and protecting them from being burned. We are acquainted with other and similar circumstances where the boilers were burned owing to a deposit of oily substances in the boiler, and we take these examples as evidence to prove that nothing but clean pure water should be allowed to enter a boiler.

(5) F. H. S., Williamsport, Pa., writes: I would ask if you could inform me the rule for balancing crank cross head and pitman, so as to run without jarring? I am building strain scroll saw and large mortiser machine and have some trouble with crank movement. *A.*—Your question involves a question of centrifugal force, and in order to accomplish the desired result you must do one of two things, viz.: Ascertain the weight of the reciprocating parts, also determine the speed at which it is to run and, by the use of intricate formula, work out an approximation to the practical result; or attach counterbalances of different weights and test the results practically until you arrive at a satisfactory effect. You can counterbalance so as to run steady only at a certain speed, for if the machine runs faster or slower it will run unsteady. Consult the AMERICAN MACHINIST for Nov. 13, 1880, for rules on centrifugal force.

BUSINESS SPECIALS.

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Thomas D. Stetson, Patent Solicitor and Expert in Patent Cases, No. 23 Murray Street, New York.

See Christiana Machine Co.'s adver., on page 14.

James W. See, Designing and Consulting Engineer, Hamilton, Ohio.

J. C. Hoadley, Engineer and Expert, formerly of Lawrence, Mass., has opened an office at 29 High St., cor. Federal, Boston, Mass., where he will be pleased to receive old and new friends.

MANUFACTURES.

F. W. Bird, Hollingsworth & Co., East Walpole, Mass, are setting a new Benzon steel boiler, and resetting an old boiler, at their lower mill, with the Jarvis Furnace. They will use screenings and wet peat for fuel.

The Canada Cotton Manufacturing Company, Cornwall, Ont., are setting four new boilers with the Jarvis Furnace,

The St. Louis Sub-pumping Station is putting in a Worthington pump and two new boilers, to be set with the Jarvis Furnace, to burn slack coal.

C. W. LeCount, South Norwalk, Ct., writes us:

In regard to my business, I can safely say it is improving. My sales last month were larger than for many months previous, and I am looking for a large trade this season.

Wilkinson Brothers & Co., Birmingham, Conn., are building their new chemical pulp mill with great rapidity. They have set three new steel tubular boilers with the Jarvis Furnace, to burn cheap fuel. They are also constructing three soda-ash reclaimers with the same furnace.

Grantham, N. H., has voted to exempt from taxes for ten years any establishment that may be erected for the manufacture of materials from wood, wool or iron.

John Royle & Sons, Machinists, of Paterson, N. J., contemplate moving into larger quarters, in consequence of the increase in their business.

A new cotton manufacturing company is to begin operations in Westport, Conn., March 1, with a capital of $25,000.

Thompson and Holmes have put several new machines into their chuck manufactory at Rockville, Conn.

James A. Bates of South Abington, Mass., is to engage in the manufacture of brushes and repair of machinery, and will occupy the Brigham factory.

Among the new industries of Milwaukee, Wis., there are to be a sewing machine factory, a car works, a scale works, a glass works, and other shops, requiring machinists and skilled artisans.

The machine shop at Gloucester, Mass., owned and occupied by A. P. Stoddard, was recently destroyed by fire.

The Raleigh (N. C.) *News* wishes it known that that State has 57 cotton factories in operation on full time and still unable to fill all their orders, and many more in process of construction.

The Judiciary Committee of the Common Council of Chicago has presented a unanimous report in favor of the erection of pumping works on the South Side, capable of pumping 18,000,000 gallons of water daily.

The United States Electric Light Company has purchased the large building at Avenue B and Seventeenth street, New York City, intending to use it as a manufactory of the Maxim lamps and other electric apparatus.

A paper manufacturing firm has purchased twenty thousand acres of Somerset County, Pa., mountain timber, and a large gang of workmen has been sent to the tract to begin improvements. Work will be begun on a large store building, thirty dwelling houses, and an enormous digester for the cooking and steaming of wood in the manufacture of pulp, and a huge building to be used in the manufacture of paper sacks and wrapping paper. All these preparations are preliminary to reducing twenty thousand acres of forest to news, book and fine writing papers.

A new company has been formed at Phillipsburg, N. J., to be known as the American Sheet Iron Company, with a capital of $150,000. They have bought the property known as the McClees mill, which is to be enlarged and improved. The company will employ about 300 hands.

The Betts Machine Company, Wilmington, Del., have received several large orders since the 1st of the year; among others one from the Pennsylvania Steel Company, Harrisburg, Pa., for four more of the heavy planing machines, just like two they supplied them with in October last—made with steel gearing throughout, to do the very heavy work required on their steel railroad forgings.

The new machine shop erected by Lowerie & Tucker, Newark, N. J., for the manufacture of the Crown Jewel and Eureka fluting machines, will be occupied by them about February 1st. The building is built of brick, 25x100 feet, and three stories high, and will greatly increase their capacity.

The Collier White Lead and Oil Company, St. Louis, Mo., are setting four boilers with the Jarvis furnace, to burn slack coal and waste tan bark.

Blain Bros., car builders, Huntington, Pa., have an order to build 900 cars for the Texas Pacific Railroad. They are enlarging their works and will put in the Brush electric light; also set three new boilers with the Jarvis furnace.

Armington & Sims, Lawrence, Mass., are very busy with orders for the Lawrence engines. They are making high speed engines for the Newmarket Manufacturing Company, Willimantic Linen Company; Attawangan Mills, Norwich, Conn.; P. C. Cheney Company, Manchester; H. N. Slater Manufacturing Company, Webster; Davis & Hurber, North Andover; A. F. Smith, Lynn; Lane Cotton Company, New Orleans. They will enlarge their works soon and double the capacity to enable them to fill their increasing orders.

Hewes & Phillips, Iron Works, corner Orange and Ogden streets, Newark, N. J., write us:

We are exceedingly busy and full of orders, and the prospects for a busy year are the very best.

Bliss & Williams, 167 to 173 Plymouth street, corner of Jay, Brooklyn, N. Y., write us:

Our business for 1880 was most satisfactory, largely in excess of any previous year, and we are pleased to say that the prospect is good for a continued increase.

Having in the past two years more than doubled our producing facilities, we are constantly running full, and find the trade appreciative, ready to adopt improvements, and to pay for skillfully constructed tools and labor-saving machinery.

We take pleasure in recording the organization and incorporation of the Hartford Engineering Company of Hartford, Conn., of which Drayton Hillyer is President; Sidney M. Gladwin, Secretary and Treasurer *pro tem.*; William Lee Church and George A. Barnard, Engineers; and C. F. McMurray, Comptroller. The company has a paid up capital of $300,000, and shows upon its list of stockholders many prominent capitalists and manufacturers of New England.

The Directors are: Drayton Hillyer, Chas. M. Beach, George M. Bartholomew, George Maxwell, Henry C. Robinson, William Lee Church, and George A. Barnard. The company has purchased the entire property formerly known as the Woodruff & Beach Iron Works, and are making extensive enlargements. They have contracted for an entire plant of new tools, selected with care from the best builders, many of them being special tools designed for their work. In their outfit and system of manufacture it is the intention to make these the model shops of the country.

This enterprise is a direct outgrowth from the Buckeye Engine Company, who for the past two years have been unable, notwithstanding successive enlargements, to keep pace with the demand for their engine in the New England and Middle States. They have, therefore, granted to Messrs. Church & Barnard exclusive license to manufacture the Buckeye engine, and upon this license the business of the Hartford Engineering Company is based. To the engine business they will, however, add the manufacture of specialties in other departments of mechanical engineering. These specialties have been carefully selected as being of novel and pronounced merit, and will in due time be placed upon the market. Particular attention will be given to compound engines embodying the latest practice.

Advantage will be taken of this opportunity to introduce several improvements into the Buckeye engine, which have been for some time in contemplation, and it is intended that the product of every department of these works shall be, in design, material, and workmanship, the standard of its kind.

The company has adopted a title of broad significance, and their business will be to combine the most intelligent and conscientious practice of modern engineering with contracting for everything relating to the generation and distribution of steam power. The well-known ability and enterprise of the engineers of the company give full assurance of carrying out such a plan.

The works have a present capacity of 400 men, and will be under the personal superintendence of Mr. Church. They are already pressed with orders, and their contracts for tools are so placed that they will start up with about half their force by April 1st.

The Rollstone Machine Co., Fitchburg, Mass., write us that they are pushing business to the full capacity of their works, and are now making changes in both office and shop, which the increase of business demands. Orders for their Wardwell Patent Saw Benches from foreign countries, as well as at home, are so numerous that they are unable to keep up to them with the supply.

The projectors of the new Iron Steamboat Company, recently incorporated in New York City, announce officially that subscriptions have been received for stock greatly in excess of the amount offered.

Concerning the Cotton Exhibition, which it is proposed to hold at Atlanta, Ga., next year, a recent interview with some Northern gentlemen is published in the *Atlanta Constitution*. We quote from one of the conversations:

I maintain that above everything else the Exposition will show to the capitalists of the country that here in Georgia, and throughout the South, is the place to build cotton factories. Everything points to the soundness of this conclusion. The most prosperous mills in the country are here. The staple is right at your doors, while the manufacturer of New England is paying high freightage upon it. You have numerous rivers and streams furnishing excellent power and an abundance of clear water for manufacturing purposes. Good mill privileges, I am told, can be had for almost nothing. Fuel is in good supply for large steam factories, and the construction of your Georgia Western Road will furnish it in inexhaustible quantities. Skilled labor is to be obtained at fair wages—in fine, you have all the advantages of New England with the staple which she has not. By all means the South should modify its interest in cotton through the growth of manufactures. So long as the sale of raw cotton is the only or principal method of realizing money from its cultivation, the planter cannot afford to do much in aid of domestic interests. Show these things to the moneyed men of the North; attract them hither to investigate for themselves; only let them see the splendid chances for investment here in industrial pursuits—and in a few years Atlanta will be the Manchester of America; the loom will weave a fabric of indissoluble interest and brotherhood between the South and North.

Machinists' and Engineers' Supplies.

NEW YORK, Jan. 13, 1881.

The supply market continues active, and since the recent advance in the prices of machine tools there is an apprehension that they will become still more scarce. Many articles in the supply line are on a balance, it being difficult to say whether they will rise or fall.

We have received the following circular from L. B. Eaton, of Philadelphia, which explains itself:

On and after January 15th, 1881, L. B. Eaton (Tool Store, 11 North 6th Street,) will be succeeded by L. B. Eaton & Rexford.

All accounts due L. B. Eaton must be paid to the new firm, who will also settle all the accounts payable by L. B. Eaton. LUTHER B. EATON.
RICHARD W. REXFORD.

Philadelphia, Jauuary 12th, 1881.

The business of the late Wm. A. Lighthall will hereafter be conducted by his son Wm. H. Lighthall and associates, under the firm name of Wm. H. Lighthall & Co., No. 5 Bowling Green, New York.

There has been an advance of 10 % on leather belting in accordance with the decision at a manufacturers' meeting.

Iron and Metal Review.

NEW YORK, January 13, 1881.

Though the market presents a quiet apperance, yet we are convinced that considerable business has been transacted during the week. Prices are firm as follows: Foundry No. 1, $25: No. 2, $22; Gray Forge, $20; Scotch Pig is in very active demand and prices are more firm. Chas. G. Lundel, importer of Swedish iron, 7 Exchange Place, Boston, Mass., writes us that the prospects for this year are promising, although there has been no special imorovement thus far, and the importations may fall somewhat less than last year. This is owing to the fact that many consumers anticipated their wants and are well stocked at the present time. The following price list was enclosed.

Swedish Pig	from $36.00	to $45.00	per ton, ex	ship
Rough bars	from 72.50	to 75.00	" ex	"
Finished bars	from 80.00	to 92.50	" ex	"
Wire Rods, No. 4	from 90.00	to 100.00	" ex	"
Bolt Rods,	from 97.50	to 110.00	" ex	"
Dannemora Bars, f'm	100.00	to 145.00	" ex	"

All Swedish Iron is Charcoal Iron, and therefore does not compete with the mills producing ordinary refined iron.

The prices of manufactured iron remain unchanged as follows:

American Iron Rails, $50 to $53, according to weight; Fish Plates, 2½c. per lb.; Railway Spikes, 3c.; Bolts and Nuts, 3½c.; Common Bar Iron, 2.3c., basis from store, Refined do. 2.5c., basis; Ulster, 3 6-10 basis; Machinery Steel, 6½c.; Best Tool Steel, 13½c.; Norway Bar Iron, 6¾c.; Norway Shapes, 6½c.; Nail Rods, 6¾c.; Sheet Iron, 3¼c., basis; Angle Iron, 3c.; Tee Iron, 3½c.; Band Iron, 3 2-10c.; Hoop Iron, 3.5c., and up according to size; Horse Shoe Iron, 3 2-10c.; Hot Polished Shafting in lengths, 2 ft. and longer, 9 to 10½c., according to size; Small Black Rivets, 30% off in papers; 10% off in bulk.

There is nothing new to note in the metal market.

Boiler plates are strong at the following prices: Tank, 3c.; Refined, 3¼c.; Shell, 3¾c. to 4c.; Flange, 4¾c. to 5c.; Firebox, 5½c. to 6c. Boiler tubes are selling at 40 per cent. discount from list

WANTED

Wanted—An Experienced Mechanical Engineer as Superintendent. One well known to the trade and competent to estimate. Give reference and address. Atlantic Steam Engine Works, Brooklyn, N. Y.

Wanted.—Machinists and tool makers wanted by the Brown & Sharpe Mfg. Co., Providence, R. I.

Situation wanted by a first-class mechanical draughtsman with large experience. Is a good designer for marine engines, sugar estates, and millwork. Address, M. S. M., AMERICAN MACHINIST, 96 Fulton street, New York.

A metallurgical engineer wishes to engage with a suitable party. Is capable of producing steel castings, free from blisters, and perfectly homogeneous in strength and toughness equal to the best Swedish wrought iron, and at an expense not above that of common pig iron castings. Party answering must be a man of means. Address, Metallurgy, care AMERICAN MACHINIST, 96 Fulton street, N. Y.

Wanted.—An experienced Machine Tool Draughtsman with prospect of permanent situation at good wages. Address, stating experience, salary desired, &c., "Tool Shop" care AMERICAN MACHINIST.

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THE BEST IN EXISTENCE.

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And can be Cleaned Out while Steam is in the Boiler.

It has been tried for two years, and has given entire satisfaction on both Stationary and Marine Boilers. For descriptive circular address

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LEVER VALVE,
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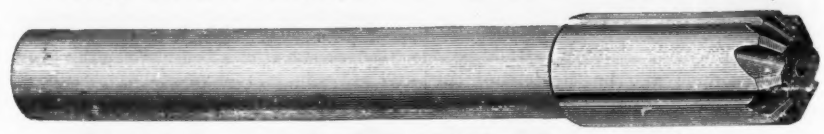

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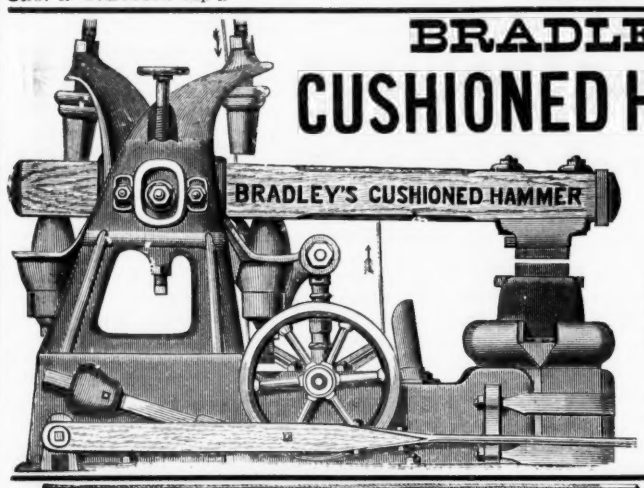

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Messrs. KEARNEY & FOOT, New York, New Haven, Conn., Nov. 1st, 1878.
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We print instructions on the use of Files, and also give the diameters of round and square Files from 3 to 16 inches. They are on card board, 10x12 in., and are intended to be put up in the shop for the men to read. We are pleased to mail them to any manufacturer on receipt of the necessary 6 cents postage.
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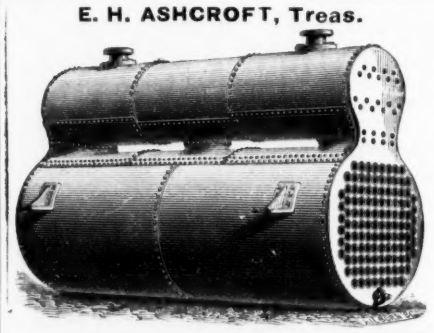

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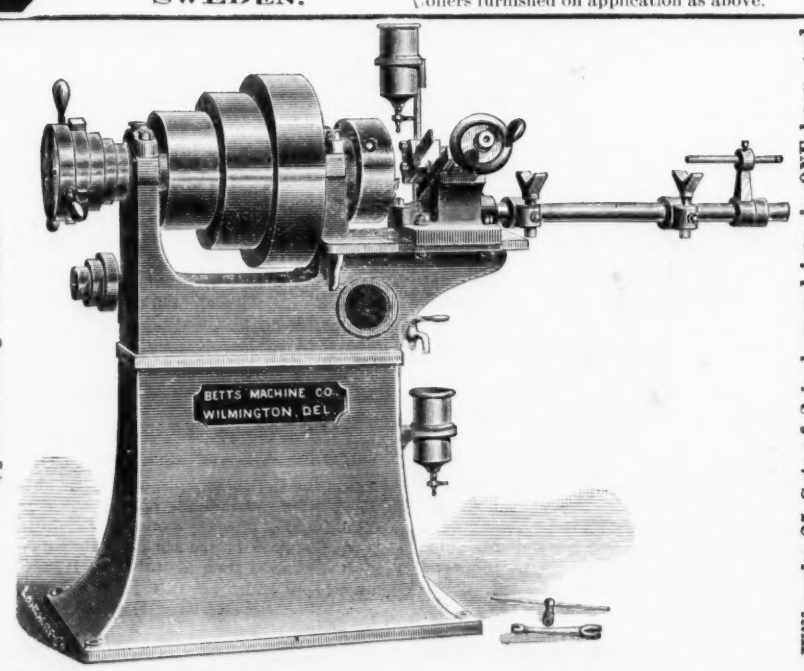

Will make 25 Cuts of 2 inch round iron in ONE hour, and leave the ends in FIRST RATE condition.

BETTS MACHINE CO., Wilmington, Del.